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Impact of Proposed and Alternative 'De Minimis' Levels for Criteria Pollutants

PEDCo Environmental, Inc.
Durham, NC

Prepared for

Environmental Protection Agency
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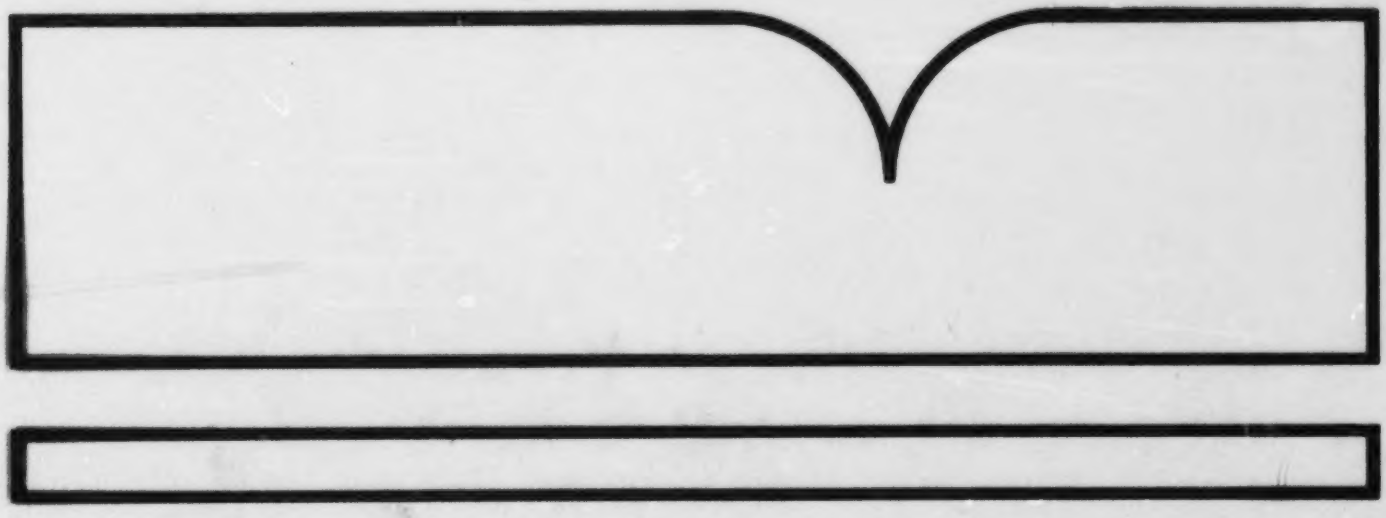
Jun 80



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16. ABSTRACT

The report estimates the impact of the prevention of significant deterioration (PSD) regulations under various applicability size cutoffs for criteria pollutant emissions. The analysis is based on the information obtained from completed PSD permitting actions. The report summarizes existing permit data by showing distributions of: 1) emissions levels of criteria pollutants; 2) actual and effective stack heights; 3) maximum downwind air quality impact; and 4) emissions associated with specific air quality impacts. The report also evaluates the combined worst case air quality impacts from several sources making a de minimis change in emissions and the impact of changes over distance from pristine (Class I) areas.

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SECTION 1

INTRODUCTION

In 1974, EPA promulgated regulations to prevent emissions of sulfur dioxide (SO_2) and particulate matter (PM) from significantly deteriorating air quality in areas where the air quality concentrations were lower than the applicable National Ambient Air Quality Standard (NAAQS). These regulations prevented the construction of certain categories of new or modified sources unless a permit had been issued which indicated that the proposed source would apply Best Available Control Technology (BACT) for SO_2 and PM and that the emissions of SO_2 and PM would not cause significant deterioration of air quality.

On August 7, 1977, the President signed the Clean Air Act Amendments of 1977 into law. These amendments established a new set of requirements for the prevention of significant deterioration (PSD). These new requirements follow the basic outline of the 1974 regulations but are more elaborate and in some cases more stringent. In response to the 1977 Amendments, EPA promulgated regulations on June 19, 1978, to amend the 1974 regulations to make them consistent with requirements of the Clean Air Act.

1.1 PROPOSED PSD REGULATIONS

In response to the June 19, 1978, PSD regulations, many industrial and environmental groups petitioned the United States Court of Appeals for the District of Columbia circuit to review the substantive provisions of the June 19, 1978, PSD regulations. On June 18, 1979, the court issued a decision that upheld some of those provisions and overturned others. (Alabama Power Company v. Costle, 13 ERC 1225). In its opinion, the court summarized its rulings and indicated that it would provide a complete comprehensive opinion at a later date. Based on the June 1979 court decision, EPA proposed on September 5, 1979, to revise the June 19, 1978, regulations to comply with the court's decision. The final court decision was issued on December 14, 1979.

One of the major elements of the proposed regulations (September 5, 1979) is the revision of the definition of "major modification." Under the June 19 regulations a modification is "major" if its potential emission increases would equal or exceed the applicable 100/250 ton threshold. The court rejected this approach. It held that a change in a major source is subject to review if it results in a net increase in the source's potential to emit after all contemporaneous emission reductions at the source are considered.

1.2 DE MINIMIS CONCEPT

In Alabama Power, the court provided that EPA may exempt from review those situations determined to be de minimis. Specifically, the court stated:

> The Agency does possess authority, inherent in the statutory scheme, to overlook circumstances that in context fairly may be considered de minimis.

The court spoke to EPA's capability to exempt modifications with small net increases and to permit proposed sources (new or modified) to avoid BACT review and the ambient monitoring requirements through the application of de minimis thresholds for those pollutants emitted from a source that would otherwise be subject to review.

The September 5 regulations proposed to exercise the above authority by establishing a pollutant-specific exemption system that excludes or limits review of proposed sources having emission levels or air quality impacts below certain values. Table 1 contains for each pollutant regulated under the Act an emission cutoff that would be considered to cause an insignificant or de minimis air quality impact. The values proposed in Table 1 have two principal uses; the first would be to show that a net increase from a modification would be de minimis for all pollutants for which the source is major, and the second would be to limit the pollutants (from the source already subject to review) to which BACT must be applied or for which an air quality analysis must be submitted.

Table 2 proposes certain air quality concentrations which are used to limit the air quality review of certain pollutants that would have emission levels greater than those in Table 1. In order to apply Table 2, a source must use a preliminary screening technique to determine if its air quality impact would exceed the acceptable de minimis levels. The screening technique is set forth in Guidelines for Air Quality Maintenance Planning and Analysis, Volume 10, (Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources (October 1977).[1] If a source's impact is expected to exceed the de minimis levels, based on the Volume 10 approach, a source may elect to use a more sophisticated modeling analysis. Upon showing that the anticipated air quality impact would be less than significant (i.e., less than the air quality concentrations in Table 2), a major new or modified source would not be required to conduct a detailed ambient impact assessment with respect to PSD for that pollutant. Therefore, such a source would not be required to perform an analysis of its impact on the increments and NAAQS. Additionally, the source would not be required to analyze its effect on soils, vegetation, and visibility, nor would it be required to conduct any ambient air quality monitoring for those pollutants with predicted concentrations less than those in Table 2.

TABLE 1. DE MINIMIS EMISSION LEVELS

Pollutant	Tons/yr
Carbon monoxide	100
Nitrogen dioxide	10
Total suspended particulates	10
Sulfur dioxide	10
Ozone (VOC)	10
Lead	1
Mercury	0.2
Beryllium	0.004
Asbestos	1
Fluorides	0.02
Sulfuric acid mist	1
Vinyl chloride	1
Total reduced sulfur	
Hydrogen sulfide	1
Methyl mercaptan	1
Dimethyl sulfide	1
Dimethyl disulfide	1
Reduced sulfur compounds	
Hydrogen sulfide	1
Carbon disulfide	10
Carbonyl sulfide	10

TABLE 2. AMBIENT AIR QUALITY *DE MINIMIS* LEVELS

Pollutant[a]	Level, μg/m³
Carbon monoxide	500, 8-h avg
Nitrogen dioxide	1, annual avg
Total suspended particulates	5, 24-h avg
Sulfur dioxide	5, 24-h avg
Lead	0.03, 3-mo avg
Mercury	0.10, 24-h avg
Beryllium	0.005, 24-h avg
Asbestos	1, 1-h avg
Fluorides	0.01, 24-h avg
Sulfuric acid mist	1, 24-h avg
Vinyl chloride	1, max value
Total reduced sulfur	
Hydrogen sulfide	1, 1-h avg
Methyl mercaptan	0.5, 1-h avg
Dimethyl sulfide	0.5, 1-h avg
Dimethyl disulfide	2, 1-h avg
Reduced sulfur compounds	
Hydrogen sulfide	1, 1-h avg
Carbon disulfide	200, 1-h avg
Carbonyl sulfide	100, 1-h avg

[a]No *de minimis* air quality level has been proposed for ozone; any net increase of 10 tons/yr of VOC subject to PSD would require an ambient impact analysis, including the gathering of air quality data.

The proposed regulations indicated that the values in Tables 1 and 2 were not supported by extensive analysis. Therefore, the following analysis was undertaken to provide further guidance and insight into the selection of the *de minimis* levels to be used in the final promulgation of the PSD regulations.

SECTION 2

PURPOSE OF THE ANALYSIS

The purpose of this analysis was to provide technical support, guidance, and insight for the selection of de minimis levels to be used in the promulgation of the final PSD regulations.

2.1 DETERMINATION OF AIR QUALITY IMPACTS OF SOURCES THAT HAVE RECEIVED PERMITS TO DATE

Since the de minimis concept is generally based on the air quality impact of a source, it is important to determine what the air quality impacts might be for sources that would be affected by the de minimis concept. A source, based on its emissions, may be of regulatory concern, but it may have an insignificant impact on air quality and thus have little or no need for preconstruction review as it relates to air quality management programs. Therefore, a major purpose of this analysis is to determine the air quality impacts of sources subject to PSD review under the current (June 19, 1978) regulations. Many of the sources that are subject to the current regulations (because of their source configuration, type of emissions, dispersion characteristics, and the particular areas where they plan to locate) may have air quality impacts that would be insignificant in terms of the PSD increments or the NAAQS.

Since over 600 PSD permits have been issued to date for a variety of new and modified sources, it seemed appropriate to review the air quality impacts of these sources if they were provided and to calculate the air quality impacts if they were not provided. A review of these 600 permits would yield a realistic estimate of the range or distribution of air quality impacts that would be associated with sources affected by the de minimis concept proposed on September 5, 1979.

Analysis of this distribution could be used to analyze selected air quality concentrations for determining the impact of the de minimis concept, in terms of both the environmental and administrative impacts.

2.2 DETERMINATION OF EMISSION LEVELS ASSOCIATED WITH CERTAIN AIR QUALITY IMPACTS

In the September 5, 1979, PSD regulations, certain de minimis emission levels associated with specific air quality concentrations were proposed for determining whether a source with small net increases in pollutant-specific emissions would be subject to PSD review. At the time of the proposal, it was stated that an analysis of the proposed emission levels and air quality de minimis concentrations would be provided later. A key aspect of this analysis is the relationship of the air quality impact associated with the emission levels proposed for each pollutant. Because this relationship is basically empirical, realistic data are needed to determine this relationship. The best available data set is the more than 600 PSD permits that had been issued from April 1, 1978, to November 1, 1979. The emissions and air quality data from these permitted sources were used to determine the relationship of predicted air quality concentration (χ) to mass emission rate (Q). The use of these available data made it possible to characterize the empirical relationship (χ/Q) for SO_2, nitrogen oxides (NO_x), carbon monoxide (CO), total suspended particulates (TSP), and lead (Pb). An empirical relationship could not be developed for hydrocarbons (HC) or volatile organic compounds (VOC) and ozone (O_3) because of a lack of a recommended dispersion model. Five types of ozone prediction methods are currently available. These models vary from simple algebraic relationships to sophisticated numerical models. In general, the simple methods tend to ignore or treat superficially many atmospheric processes that affect the formation of ozone. On the other hand, the sophisticated model treats these processes in such detail that considerable species-specific emissions data are needed as input. Additionally, all these models are more for a regional than for a specific individual source application.

It should be noted that this analysis centered on the criteria pollutants since very little, if any, data exist regarding the air quality/emission relationships for noncriteria pollutants. Only limited emissions data on noncriteria pollutants existed in the permit files, and no data were available on the associated air quality impact of these noncriteria pollutants. As a result, the de minimis levels for the noncriteria pollutants may have to be set on the basis of a percentage of the applicable emission standard for these pollutants; however, the relationships developed for some of the criteria pollutants could be used to obtain a relative indication of the associated air quality/emissions relationship that might exist for the noncriteria pollutants.

Since the first test for exemption under the de minimis concept is an emission level, a major purpose of this analysis was to determine the emission rates associated with specified air quality concentrations. Given the percentage of sources that would have a specific air quality impact at a given emission rate, one can determine the average emission rate (based on a

variety of sources) that would cause a significant air quality impact, as defined by the de minimis levels.

2.3 NUMBER OF SOURCES TO BE AFFECTED BY DE MINIMIS CONCEPT

Another purpose of this analysis was to determine the number of sources that would be affected under the proposed de minimis levels and the number that might be affected under other selected de minimis levels. Although the court did limit EPA's discretion in formulating the de minimis levels by stating that a cost-effective rationale would not be appropriate, the extent of the impact of the proposed versus any final de minimis levels is important in determining the number of reviews that would be required as a result of the final promulgation. Since some modifications not subject to the current PSD regulations would be subject to the proposed regulations, the number of additional reviews that would be required was needed in order to determine the possible workload that would be incurred by certain specified de minimis levels.

If the number of additional reviews is substantial, this could create serious problems in terms of manpower available for reviews and time required to obtain a permit. Both problems could affect the quality of the review, the overall costs of obtaining a PSD permit, and delays in construction.

2.4 URBANWIDE AIR QUALITY IMPACT DUE TO DE MINIMIS CHANGES IN EMISSIONS

Another purpose of this analysis was to determine the overall air quality impact for an area if all the major sources within the area emitting over 100 or 250 tons/yr proposed to modify.

While one source may modify its facility and not cause a significant air quality impact, a number of sources making such a change could cause a significant impact. If the sources were located near to each other, the cumulative air quality impact could consume a significant amount of the increment. Since the extent of the impact is directly proportional to the number of sources and their relative proximity to each other, it is important to determine the potential air quality impact from a number of existing sources making de minimis changes in emissions. A set of existing source data was used to determine the impact of modifying by a de minimis amount so that the estimate obtained would represent that which would be expected to occur for a given set of sources. By using actual sources with specific locations, one can obtain a reasonable and realistic assessment of the overall urbanwide air quality impact of the de minimis concept.

2.5 IMPACT WITH RESPECT TO CLASS I AREA

The proposed regulations place certain limitations on the use of the air quality de minimis levels (Table 2). The exemption from PSD review because of de minimis levels does not apply to major construction that would be located in a nonattainment area or that would adversely impact a Class I area. Therefore, the final purpose of this analysis was to determine the maximum distance from a Class I area where a source making a de minimis change in emissions would be expected to have a 1 $\mu g/m^3$ impact (defined as significant impact on a Class I area) averaged over a 24-h period. This determination would provide insight into the relative distance from the Class I area beyond which de minimis changes would not have a significant impact upon the area.

SECTION 3

METHODOLOGY

The following methodology was used in the analysis of the de minimis concept proposed by EPA on September 5, 1979.

3.1 SELECTION OF SOURCES TO BE EVALUATED

The data base for this analysis is the approximately 600 PSD permits issued between April 1, 1978, and November 1, 1979. This data base represented information on a variety of new and modified sources in several different source categories and was obtained by reviewing the permit files in EPA Regional Offices III-X. For each permit, several pieces of information were summarized on the survey form shown in Figure 1.

Since the analysis of the de minimis concept is centered on the emissions and the associated air quality impact for each source, the data on both were reviewed for each permit if available. The sources were separated into three categories:

1. Those for which dispersion modeling had been conducted and the results presented

2. Those for which modeling had not been conducted, but which had sufficient emissions and stack data to conduct dispersion modeling

3. Those for which no modeling had been conducted and for which insufficient data were available for additional modeling.

Those in the first two categories were further reviewed to determine whether they were new or modified sources and whether they emitted more than 100 tons/yr. This further categorization was necessary to evaluate the sources that would be most affected by the de minimis levels.

Since new and modified sources emitting more than 100 or 250 tons/yr are subject to PSD review, the de minimis levels are only used to determine the pollutants for which BACT review is required. However, the modifications emitting less than 100 tons/yr at major sources are affected by the de minimis levels in that these levels determine whether the modifications must obtain a PSD permit. Therefore, the major focus of this analysis was on those modifications of less than 100 tons/yr. The permit data

SEPTEMBER 5, 1979 PSD ASSESSMENT

Page____of_____

Source Type/Size:_____EPA RO___PEI NO._____

Name/Mail Add.:_____County_____

Located In: ATT/NA area of AQCR No.____at UTM_____and impacts ATT/NA area

Determination is: CONDITIONAL/FINAL/PENDING for NEW/MODIFIED/RECONSTRUCTED/REPLACEMENT Source.

Key Dates: Application-Recd._____, Completed_____; Determination-Proposed_____, Final_____

	"A"-EMISSIONS - ton/yr								"B"-PERMIT CONDITION ON:		
Affected Facilities (Name and Number)	Type*	Max/PC** capacity	At capacity Uncontr.	At capacity Contr.	Allowable under: BACT	SIP	NSPS or NESHAPS	LAER or other specify	Oper. hours	Fuel type/ amount	Materials type/ amount

"C"- FUGITIVE SOURCES						"D"- AIR QUALITY IMPACT			"E"- MONITORING NETWORK		
(Name and Number)	Type*	Dust-ton/yr Uncontr.	Dust-ton/yr Contr.	Emissions-ton/yr Uncontr.	Emissions-ton/yr Contr.	Type*	Max. Conc. $\mu g/m^3$	km from source	Start Date	Type*	No. Monitors

* Specify pollutant - use PM, SO_x, NO_x, HC, CO, Pb for NAAQS; Hg, Be, As, VCl for NESHAPS; SA, TRS, RCS, Fl for NSPS

** If source operates at other than maximum capacity due to permit conditions - circle "PC", insert details at "B" and complete "A" based on "permit capacity."

Figure 1. Summary form for September 5, 1979, proposed PSD regulations.

Page___of___

"F"- CONTROL EQUIPMENT

CYCLONES: Type_____; Tubes: No._____, D =_____in., L = _____ft; ΔP = ___in. H_2O; Inlet Vel. = ___ft/s;
(Source No.___) Volume =_____SCFM: Eff. = ____%; Other:_____

ESP Type_____; Total plate area = _____ft^2; SCA =_____ft^2/1000 ACFM; L/W ratio = _____
(Source No.___) Linear vel. = _____ft/s; Volume_____SCFM; Eff. ____%; Other_____

FABRIC FILTER: Type_____Cleaning Mode:_____Fabric:_____ ΔP = _____in. H_2O;
(Source No.___) Filter vel. (A/C) =_____ft/s; Volume =_____SCFM: Eff._____%; Other_____

SCRUBBER: Type_____; L/G = _____ gal/1000 ACFM; ΔP =____in. H_2O; Liquid used_____
(Source No.___) Volume =_____SCFM: Eff. = _____%; Other_____

AFTERBURNER: Temp. = _____°F; Residence Time =_____s; L/D:___Volume = _____SCFM; Eff. = _____%

OTHER TYPE CONTROLS/REMARKS/ETC._____

"G"- CONTROL COSTS

Source No.	System Cost-$x10^3 Cap:	Oper:

"H"- EMISSIONS CHANGE SINCE 8/7/'77-ton/yr

Source	Type*	Increase	Decrease	Net

"I"- STACK DATA

Source No.	No. of stacks	Diam. -ft.	Ht. -ft.	Temp. -°F	Exit vel. -fps

NOTES, REMARKS, ETC. _____

"J"- FUEL USE

Type_____;_____% A; _____% S
HV_____BTU/lb-gal-CF
Annual Use Rate:_____

"K"- AIR QUALITY MODELING

Pre-screening____Screening____
Detailed/Type _____

Figure 1 (continued)

did not indicate whether the sources were modifications to major sources (i.e., more than 100 or 250 tons/yr) because it did not matter whether the existing source was major or not under the current regulations. It was therefore assumed that all modifications that had previously received permits were modifications to existing major sources and the de minimis levels would determine their applicability with respect to PSD review.

3.2 ENGINEERING ANALYSIS

An engineering analysis of the selected modified sources to be used in evaluation of specific de minimis levels was performed to ensure that they were typical of those likely to be modified in the future. Table 3 lists the number of sources in each of 32 industrial categories that either had provided modeling results or had sufficient data available to conduct additional modeling and the number of sources considered to be typical. As shown in the table, the sample population of modified sources consisted of 57 sources, which represented 20 of the 32 major sources categories that had been issued PSD permits from April 1, 1978, to November 1, 1979. For each of the 57 sources, the following characteristics were reviewed to determine whether a source was typical: processes, capacity, emissions, control devices, stack parameters, dispersion modeling results (if available), operating practices, and fuels and feedstocks. The review revealed that eight sources were atypical; that is, the modification that had been permitted was not one typical of the type of modification that would be expected for the source category in general, or the feed stock or fuel used by the modification was not typical of the fuel or feed stock generally expected to be used by the source category. For each of the eight sources, an attempt was made to substitute permit data from new sources that had been issued PSD permits from April 1, 1978, to November 1, 1979, and that would be more typical of the sources within that particular source category.

In general, substitutions were made so that typical unit operations for a particular source category would be reflected. This is why substitutions were made in the sulfur recovery, secondary metal, chemical process, hydrofluoric (HF) acid, and fuel conversion source categories. In the sulfur recovery category, the modified source was a gas-sweetening process at a refinery rather than a sulfur recovery operation. Therefore, a new Claus plant was substituted for this modified source for this analysis. In the secondary metal category, secondary aluminium and lead plants were substituted for a modified grinding operation. The HF modification was deleted, because it consisted of adding an alkylation unit rather than a unit operation typical of acid production. No substitution was made for the HF source as no other permits had been issued for that source category. The chemical process and fuel conversion modifications were deleted because they were merely adding a boiler rather than really modifying the process, and a typical new multiple-point-source

TABLE 3. MODIFIED SOURCES USED FOR PSD DE MINIMIS ANALYSIS

	Industry category	Number of sources	Number of typical sources
1.	Fossil-fuel-fired steam generator	1	0
2.	Coal cleaning	1	1
3.	Kraft pulp mills	5	5
4.	Portland cement	2	2
5.	Primary zinc smelting	-	-
6.	Iron and steel	4	4
7.	Primary aluminum smelting	-	-
8.	Primary copper smelting	-	-
9.	Municipal incinerator	2	1
10.	HF	1	0
11.	H_2SO_4	-	-
12.	Petroleum refinery	12	12
13.	Lime plant	2	2
14.	Nitric acid	-	-
15.	Phosphate rock	-	-
16.	Coke ovens	-	-
17.	Sulfur recovery	1	0
18.	Carbon black	2	2
19.	Primary lead smelting	-	-
20.	Secondary metal	2	1
21.	Chemical process	1	0
22.	Industrial boiler	4	2
23.	Petroleum storage	-	-
24.	Taconite ore	-	-
25.	Glass fiber	4	4
26.	Charcoal production	-	-
27.	Fuel conversion	1	0
28.	Sintering	-	-
29.	Asphalt plant	6	6
30.	Rock crushing	3	3
31.	Natural gas compression	2	2
32.	Oil and gas extraction	1	1
Total		57	48

chemical plant and a new coal gasification operation were substituted in their place.

The other principal reason for substitutions of new plants for modified plants was the use of atypical fuels or feed stocks. A new coal-fired steam generator was substituted for a modified bagasse/oil-fired boiler. Similarly, in the industrial boiler category, a new coal-fired unit was substituted for a modified wood waste boiler. In addition, a new municipal incinerator was deleted because it was primarily a liquid waste incinerator and no substitution was made because no other municipal incinerator had been issued a permit during the time period analyzed.

3.3 MODEL SELECTION

In Alabama Power, the court recognized that modeling techniques would be the principal device relied upon for the projection of the air quality impact from a regulated source. Therefore, model selection is an important step in the process of determining de minimis exemptions. Although the modeling techniques set forth in the Guidelines for Air Quality Maintenance Planning and Analysis, Volume 10 (Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources[1] formed the basis of the de minimis analysis (since it was referenced in the proposed regulations), additional modeling techniques were used to provide a check on the results from the Volume 10 approach.

The preliminary model selection consisted of an initial evaluation of the three levels of air quality analyses (specified in Volume 10)--namely, simple screening, basic modeling, and refined modeling.

The simple screening technique utilizes some of the Gaussian dispersion equations outlined in the Workbook of Atmospheric Dispersion Estimates[2], which assumes flat terrain and no aerodynamic downwash.

The second level of modeling requires the use of simple computer programs--either a series of calculations set forth in Volume 10 performed on a pocket or desktop calculator or the basic EPA (PTMAX) program, which is available through the UNAMAP series. The models selected for use from UNAMAP are programed versions of the Gaussian dispersion equations. PTMAX is an interactive program for analyzing the maximum short-term concentrations from a single-point source as a function of stability and windspeed.

In this model, the final plume height or effective stack height (i.e., height of the plume centerline when it becomes essentially level) is used for each computation and is estimated by the Briggs equation. The model assumes flat terrain, unlimited mixing heights, and no aerodynamic downwash or background

concentrations. PTMAX calculates a maximum 1-hour (1-h) concentration for a given inert nonreactive pollutant under "worst case" meteorological conditions, which can then be transformed to a 3-h, 8-h, or 24-h value by multiplying the 1-h concentration by 0.9, 0.7, or 0.4,[1] respectively. By use of PTMAX, many stability-windspeed combinations can be evaluated rather quickly and the "worst case" conditions determined. This method, however, is still considered detailed screening, since it uses only limited meteorological input.

Phase three or refined modeling, which is beyond the scope of Volume 10, is defined in the Air Quality Modeling Guidelines (April 1978).[3] The preferred model simulates atmospheric transport and dispersion in the area of interest; it considers both the availability of source and meteorological data and the local topography and plant configuration. As stated in the Guidelines, however, "there is no single model capable of properly addressing all conceivable situations."[3] A single-source Gaussian dispersion model (CRSTER) is recommended when no significant terrain or meteorological complexities are encountered. For multi-source situations, the Gaussian-Plume Multiple-Source Air Quality Algorithm (RAM) is suggested in the Air Quality Modeling Guideline.[3] This model has both an urban and rural version, but only the urban version was used in this analysis. The choice of locations for receptor sites significantly affects the evaluation of source impact. When the CRSTER is used, an appropriate receptor field must be designated by the user; RAM, on the other hand, has a significant point receptor option by which the program itself selects the receptor sites.

Of the three levels of modeling available, the first was eliminated because the de minimis analysis demands more than simple screening techniques. The second was evaluated and was considered to be acceptable because it provides more realistic estimates than the first. Additionally, it is the method referenced for obtaining air quality impact exemptions in the September 5, 1979, proposed regulations. Use of the PTMAX computer model instead of a pocket or desk calculator (procedure in Volume 10) eliminates possible calculation errors and reduces the time required for obtaining concentration estimations. The refined models require a more extensive data base--for example, complete sets of surface and upper air meteorological data, detailed topographical data, and a general idea of population density for urban/rural determinations. Although the phase three technique provides the most refined estimate, it also requires considerably more detailed information and resources. Because of time, economic, and data constraints, it had limited use in this analysis; however, it should be pointed out that the more refined modeling results were used in the analysis in those cases where they were provided in the permit files.

A cross section of approximately 50 sources was selected for comparison of different concentration estimates by use of a total set of meteorological parameters (stability class, windspeed,

temperature, etc.) for one entire year with concentration averaged every 24 hours vs. a transformed 1-h concentration calculated with only one stability class, windspeed, and ambient temperature per run. Because of the time required and topographical information needed for selecting a proper receptor grid for CRSTER, EPA's urban RAM model with the significant point receptor option was selected for the comparison. These runs produced 24-h maximum values, which could then be compared to the PTMAX 1-h maximum values, transformed to 24-h averaged values by the procedures in Volume 10. The results of this analysis indicated that there was a relatively good correlation between the urban RAM and PTMAX results and that for all pollutants except SO_2 the concentrations predicted by PTMAX were slightly lower than those obtained from RAM. For SO_2, some of the PTMAX results were lower, while others were slightly higher. Therefore, for the purposes of this analysis the PTMAX results were considered comparable to those that could be obtained by use of a more refined modeling technique.

3.4 PREDICTION OF AIR QUALITY IMPACTS BY USE OF SELECTED MODELS

Air quality impacts of typical sources that had received a PSD permit were predicted with the PTMAX air quality simulation models described in Section 3.8. As previously stated, other more refined models were used but only to cross-check the results obtained with PTMAX. Input data consisted of actual plant configurations from the PSD permits issued from April 1, 1978, to November 1, 1979. The selection of this sample population for the analysis provided an indication of air quality impacts of sources expected to receive permits over the next several years, assuming similar industrial trends.

First, source air quality impacts were assessed by use of the second phase of the Volume 10 screening techniques for a sample population consisting of actual data from permits issued in eight EPA Regional Offices from April 1, 1978, to November 1, 1979. Specific parameters from the PSD permit files were input into PTMAX, which provided an analysis of the 1-h maximum concentration from a point source in flat terrain as a function of stability and windspeed. The PTMAX program was run for all windspeed-stability combinations, and the highest estimated concentration was designated as the maximum 1-h concentration. This value was then converted to an estimated maximum concentration for an 8-h averaging time for CO (1-h average × 0.7) and 24-h for TSP and SO_2 (1-h average × 0.4) by using the respective 1h/8h and 1h/24h ratios in Volume 10, which are based on general experience with elevated point sources. The ratio of the 1-h average to the annual average for NO_x (0.14) was calculated from refined modeling data compiled from modeling results from several PSD permits and previous EPA modeling studies.[4]

The Volume 10 results were adjusted, and the next highest valid data point from the PTMAX results was selected to eliminate any estimated concentrations that the program designated

should be used with caution because either (1) the height of the plume was sufficient to require extreme caution in the interpretation of the computation since the particular windspeed-stability combination may no longer exist at that height, or (2) the distance to the point of maximum concentration was so great that the same stability was not likely to persist long enough for the plume to travel that far.

The PTMAX model calculates the final plume rise by the Briggs plume rise equation. Calculations for plume rise may not necessarily be valid within the first few hundred meters horizontally from the stack, since the plume rise from a stack may occur some distance downwind at high windspeeds. Therefore, for this analysis, concentrations occurring at less than 200 m from the source were eliminated, and the next highest concentration beyond 200 m was selected.

In addition, a method (other than those outlined in Volume 10) was examined to provide a relative comparison of the predicted concentrations. The PTMAX model runs were evaluated at neutral case conditions, Class D stability, and a windspeed of 5 m/s.

Meteorological input for the PTMAX model consisted of one windspeed, stability class, and ambient temperature per run. To cross-check the effect of a total set of meteorological parameters, a more sophisticated model was run with one year of representative meteorological data for a sample of 50 sources. The EPA urban RAM model was selected because of its significant point receptor option. Land use and population density estimates were calculated to determine the applicability of the RAM urban model for particular sources in specific locations. The source's geographic location was classified as urban if land use types[6] I_1, I_2, C_1, R_2, and R_3 comprised $\geq$50 percent of the surrounding area or if the population density of the area was >750 people/km^2.

An alternate analysis was developed for the assessment of Pb because of the inherent problems with deposition and the lack of Pb sources in the PSD permit files. Because deposition is not one of the factors considered in the PTMAX model, valid air quality impacts could not be determined for Pb by this technique. The EPA modeling results for the Standards Support and Environmental Impact Statement (SSEIS) on Lead[5] were used as a supplementary data base for de minimis level evaluation of Pb. A climatological dispersion model with the ability to accommodate the deposition phenomenon was used in that report to evaluate the air quality impacts of various stationary Pb sources. Because plant configuration is an important factor in deposition, extrapolation of the SSEIS modeling results to actual situations could lead to erroneous estimates of Pb concentrations, especially in those cases where the source configuration would differ significantly from the model plants used in the SSEIS analysis. However, since these model plants are representative of typical

plants that may be constructed, the results obtained from this analysis can be used to determine the average impact from a variety of Pb sources.

3.5 RELATIONSHIP BETWEEN SPECIFIC EMISSION LEVELS AND AIR QUALITY CONCENTRATIONS

A relationship between concentration and emission rate was developed to evaluate selected de minimis cutoffs proposed by EPA; specific air quality concentrations for criteria pollutants were selected; and corresponding emission levels were calculated by several different techniques, as described below. Since the air quality increments represent a given percentage of the NAAQS, it was determined that a similar percent approach would be used to determine the level of air quality that would be considered insignificant for the purpose of avoiding a detailed PSD review when existing sources are modified. Therefore, emission rates were calculated for various air quality levels that represented specific percentages of the NAAQS.

One way of relating emissions to air quality was to develop a ratio of the concentration (χ) to the emission rate (Q) for each individual source used in the analysis. These ratios (referred to in Volume 10) were generated as useful tools to enable one to readily calculate an emission rate for a source or a group of sources, given a specific air quality value, or to calculate an air quality concentration, given a specific emission rate. Both pollutant-specific and combined pollutant χ/Q distributions were generated for the various modeling techniques described in Sections 3.3 and 3.4. The χ/Q ratio represents an incremental, normalized, air quality impact. It is normalized in the sense that the air quality concentration for each source is divided by the specific emission rate that produced the particular air quality impact, and thus permits the air quality concentrations to be compared on a common basis. This ratio represents the expected incremental change in ambient concentration ($\mu g/m^3$) due to a unit change in emissions of 1 ton/yr (0.02877 grams per second); thus the χ/Q ratio indicates a source's degradation of ground-level air quality for any emitted inert, nonreactive, and nonsettling pollutant. The χ/Q value can be multiplied by a respective Q value to determine the air quality impact of that particular emission rate, or its inverse can be multiplied by a particular air quality value to determine the Q that would contribute that concentration to the environment. These χ/Q values consider several source parameters in the relationship between concentration and emission rate since each χ/Q has a different combination of emission rate, effective stack height (H´), and meteorological parameters (stability and windspeed) factored into its determination.

The magnitude of the χ/Q value corresponds to the dispersive nature of the source in question. Since the de minimis emission levels will be used by a variety of sources, it was determined

that an average or typical situation should be used in developing the relationship between emissions and air quality to obtain a realistic and representative estimate of the emission level that would produce a given air quality impact. Because a number of different sources were used in this analysis and a distribution of the ratios of air quality to emissions was developed, it was determined that the 50th percentile values representing the average of the distributions would be used. In the selection of a 50th percentile χ/Q value from the distributions, the average dispersive characteristics of the sample (both in terms of the plant's emission characteristics and certain meteorological conditions) are factored into the analysis. Therefore, the values generated by this analysis tend to reflect representative, realistic conditions.

An alternate technique was developed for comparative purposes. The EPA PTDIS Gaussian dispersion model from the UNAMAP series, which estimates short-term concentrations directly downwind of a point source, was selected to predict a concentration-mass emission rate relationship. An option in the model allows the input of an effective stack height instead of the separate physical stack heights, stack exit velocities, stack gas temperatures, and stack diameters (as required by the PTMAX model). By using the mean effective stack height of the sample population as the input value, all the mean values of the stack parameters are factored into the model as they relate to a specific effective stack height instead of being considered as separate nonassociated average values. For example, the mean from the distribution of each parameter could yield a physical stack height of 18 m, a stack velocity of 20 m/s, a stack temperature of 400°K and a stack diameter of 1.5 m. If these average values are used, the calculated H´ would be 30 m. However, if the mean of the H´ distribution was used, the H´ would be 40 m. Using the average of the various stack parameters to construct a composite stack could produce an unrealistic stack configuration which in turn could produce an unrealistic H´. Therefore, the mean of all the calculated H´'s was used instead of an H´ calculated using a composite of several parameters.

The mean H´ is used to calculate the concentrations at various downwind distances selected by the user. The receptor grid for the model is narrowed in subsequent runs until the maximum concentration associated with the H´ and the stability class-windspeed combination is located. Since the concentration and the mass emission rate are directly correlated in a Gaussian model, the mass emission rate was input as unity to simplify calculations. The mass emission rates can be calculated by dividing the selected de minimis air quality levels by the concentrations estimated by the PTDIS model. For example, if the PTDIS-calculated concentration is 0.386 $\mu g/m^3$ at Q = 1 ton/yr, then a de minimis concentration of 7.4 $\mu g/m^3$ would have an associated Q of 7.4/0.386 or 19 tons/yr.

The 50th percentile of the H′ distribution that was calculated by using adjusted Volume 10 PTMAX results described in Section 3.4 was input into the PTDIS model along with the stability class-windspeed combinations used in the PTMAX model and an average mixing height of 1000 m. Mixing heights were varied from 700 to 1200 m to check the effect that mixing height might have on the predicted concentration, but no change in predicted concentration was noted since H′ was significantly less than these mixing height values. Each combination of stability and windspeed was run until a maximum concentration and a corresponding "worst case" condition were identified. This pollutant concentration associated with each ton of emissions can then be used to calculate the emissions associated with an air quality value, as described above. Taking the average effective stack height associated with the worst case conditions (Volume 10 approach) and using this value to calculate concentrations with the PTDIS model (which also uses the worst case conditions) results in concentrations and ultimate mass emission rates that are extremely conservative. Thus a second approach was developed, which repeats this procedure but uses the mean H′ from the H′ distribution of the neutral condition values calculated by PTMAX (Section 3.4). This approach used PTDIS with stability D and a windspeed of 5 m/s, since this was the combination for which the average H′ was calculated. These results (Section 4.5) are more realistic since the original analysis and the PTDIS runs were conducted under the same neutral meteorological condition.

In the same manner, an H′ of 30 m, D stability, and 2 m/s wind speed were input into PTDIS to duplicate conditions similar to those originally used by the EPA in the initial de minimis analysis.

3.6 URBAN AREA IMPACT OF MAJOR SOURCES MAKING DE MINIMIS CHANGES

The effect of a number of sources all making de minimis changes in a localized area was estimated to determine their composite impact in terms of air quality. The urban version of EPA's RAM (a Gaussian plume, multiple-source, air quality model) was used to estimate incremental increases in ground-level concentrations due to de minimis level increases. The effect of those increases was analyzed by inputting data for 37 SO_2 point-sources located in a medium-size Midwestern city into the model, along with 1972 meteorological data for that metropolitan area. This city was selected because the data on the sources in this area were readily available and the source configuration which existed for this city was typical of that which might exist for a number of urban areas across the United States. The mass emission rates for all 37 sources were set at the proposed de minimis levels, and a honeycomb receptor grid option was selected. The model generated 45 receptors, positioned around the sources, and estimated the concentrations at these receptors that would result from all 37 sources making de minimis changes. The worst case

day (7 m/s winds with 98.8% persistence, 272°K ambient temperature, D stability, and average mixing height of <500 m) was selected for this analysis.

3.7 CLASS I AREA PROTECTION

Modeling was conducted to estimate the impact of de minimis emission rate increases on Class I areas. The EPA PTDIS model was run at varying stability-windspeed combinations to estimate the Class I increment consumption associated with several proposed and alternate de minimis emission rate increases. The mean H′ arrived at by the Volume 10 approach, H′ = 30 m, was input into the model along with a 1000 m mixing height. In addition, the 10th and 90th percentile values (13 and 122 m, respectively) from the distribution of effective stack heights (calculated by the Volume 10 approach) were also used. Several stability class-windspeed combinations were used in calculating the predicted concentrations with the PTDIS model. Two approaches were used in calculating the maximum distance from a Class I area where a source making various de minimis emission changes would have a predicted maximum 24-h impact of 1 $\mu g/m^3$. These two approaches were used to ensure that the worst case conditions in terms of the maximum concentration and downwind distance were calculated. Since many of the Class I areas are located in areas with elevated terrain, the Valley model[7] was used to determine if terrain features would increase the distance from a Class I area where a source making a de minimis change might locate and still have a 1 $\mu g/m^3$ maximum 24-h impact on the Class I area.

SECTION 4

RESULTS

4.1 DISTRIBUTION OF EMISSION LEVELS

In order to obtain some indication of the range of emission changes from the sources for which the analysis of the de minimis levels was conducted, cumulative frequency distributions by pollutant were developed. Figures 2 through 9 show cumulative frequency distributions of the PM, NO_x, SO_x, and CO emission changes for sources to which either PTMAX dispersion models were applied or for which previous modeling results were available. Figures 2 through 5 include all sources; Figures 6 through 9 include only sources having emission changes of less than 100 tons/yr.

The cumulative frequency distribution data were plotted on log probability paper. In most cases, these plots approximated straight lines (i.e., the data appeared to be lognormally distributed). Because linear regression analysis of several plots yielded a correlation coefficient ranging from 0.97 to 0.99, which supports the lognormal hypothesis, the lognormal distribution was assumed and the distribution parameters for each data set were estimated.

In general, the lognormal distributions provided a good fit to the emissions data in Figures 2 through 5. The data distributions in Figures 6 through 9 were generally lognormal in the lower range, but not in the higher range. Note that the plotted data curves toward an upper limit value. This is because the less than 100 tons/yr emission changes are a subset of the total amount of emission changes available for analysis, and when a normal or lognormal distribution is truncated, it becomes asymptotic to the level at which the distribution was truncated. The largest range of emissions (0.05 to 2000 tons/yr) is for SO_x; CO emissions range from 0.1 to 66.0 tons/yr; PM emissions range from 1 to 600 tons/yr; and NO_x emissions range from 10 to 2500 tons/yr.

Table 4 lists the 10th, 50th, and 90th percentile values from the cumulative frequency distribution for NO_x, SO_x, PM, and CO emission changes from all sources; Table 5 lists these values for sources that have emission changes of less than 100 tons/yr. The 10th, 50th, and 90th percentiles for sources that have emission changes less than 100 tons/yr are quite similar for all four pollutants. Although the values are about 1, 15, and 75 tons/yr, respectively, when all sources are considered, the 50th

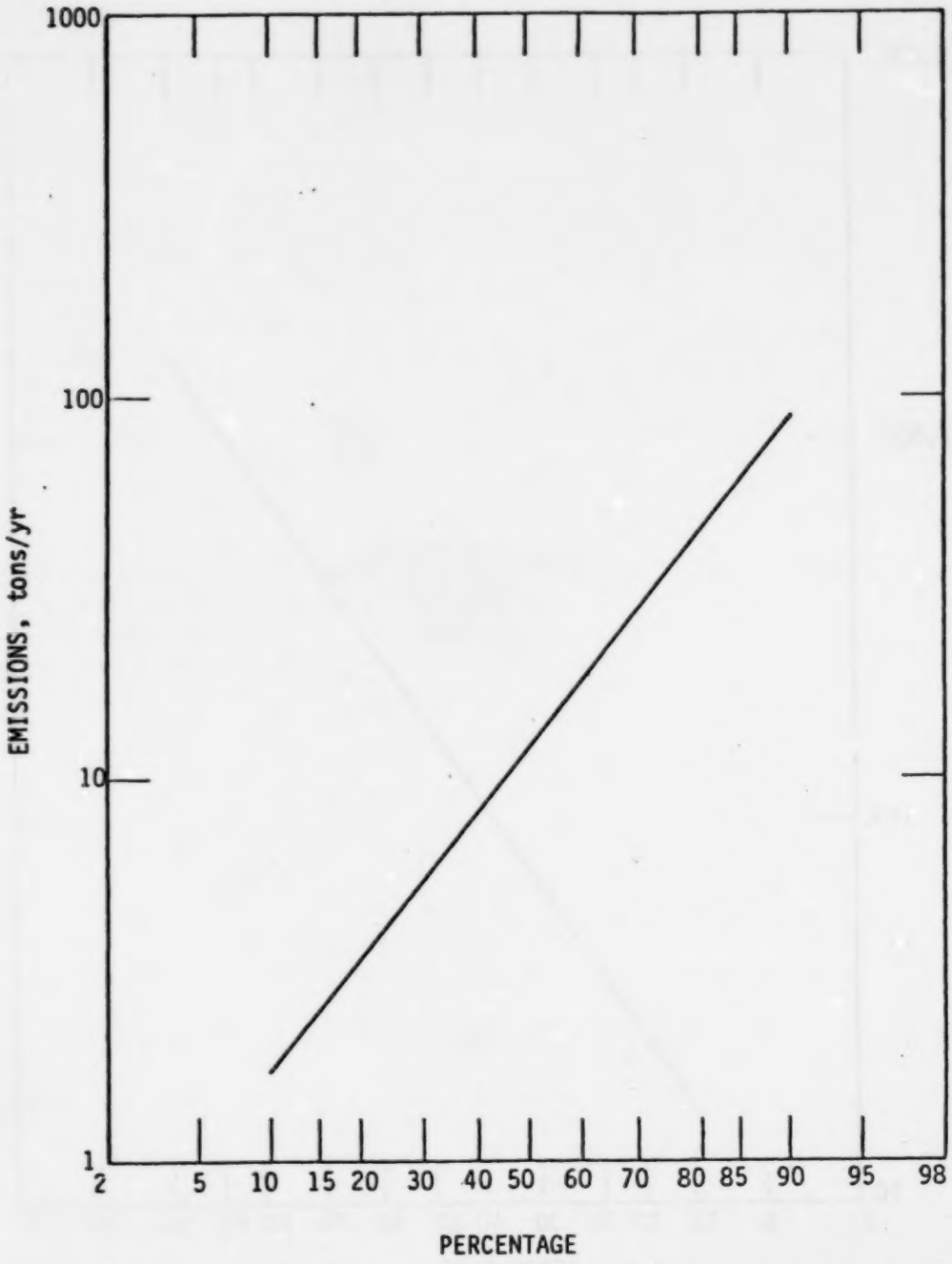

Figure 2. Distribution of particulate matter emissions for all sources used in the analysis.

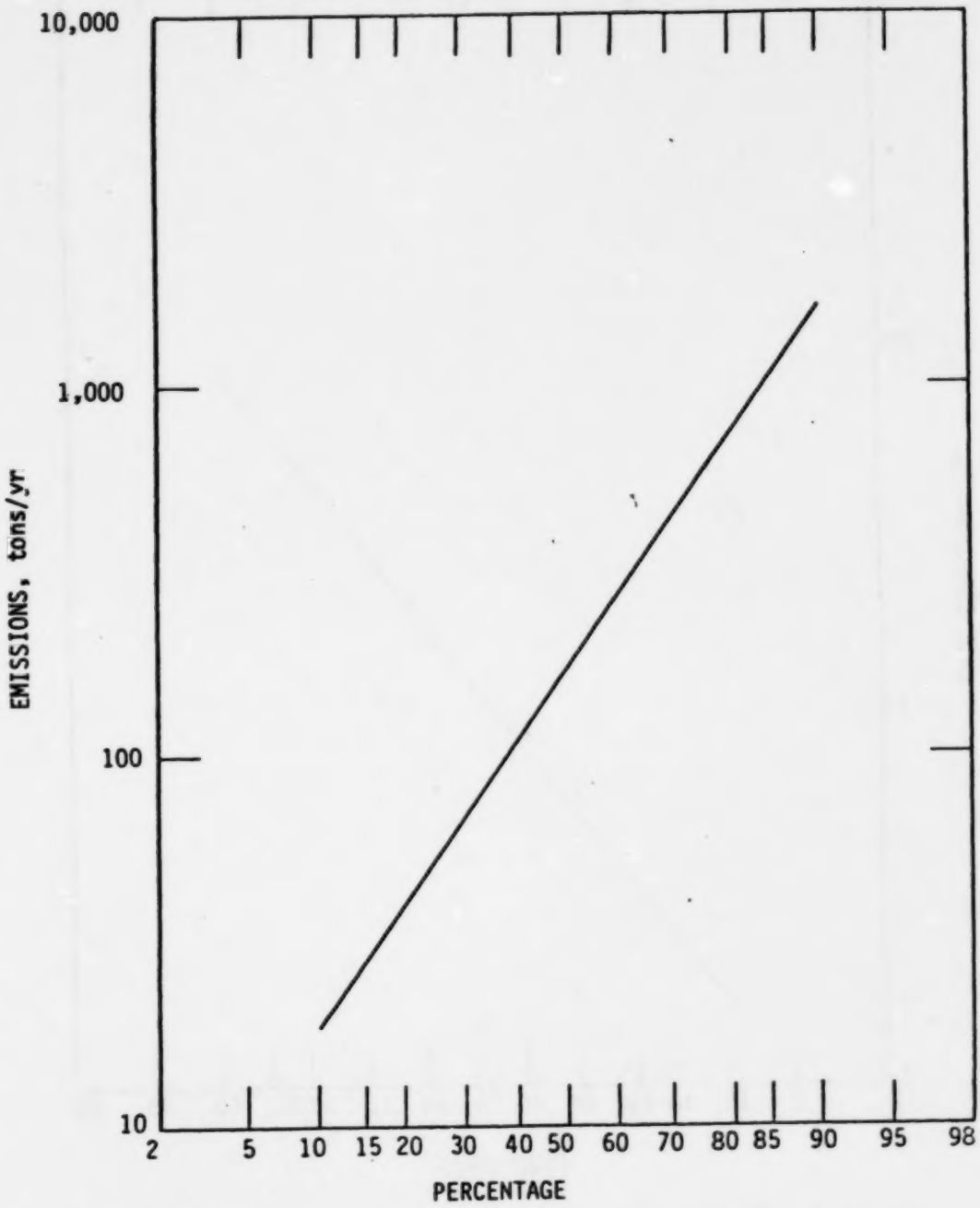

Figure 3. Distribution of nitrogen oxide emissions for all sources used in the analysis.

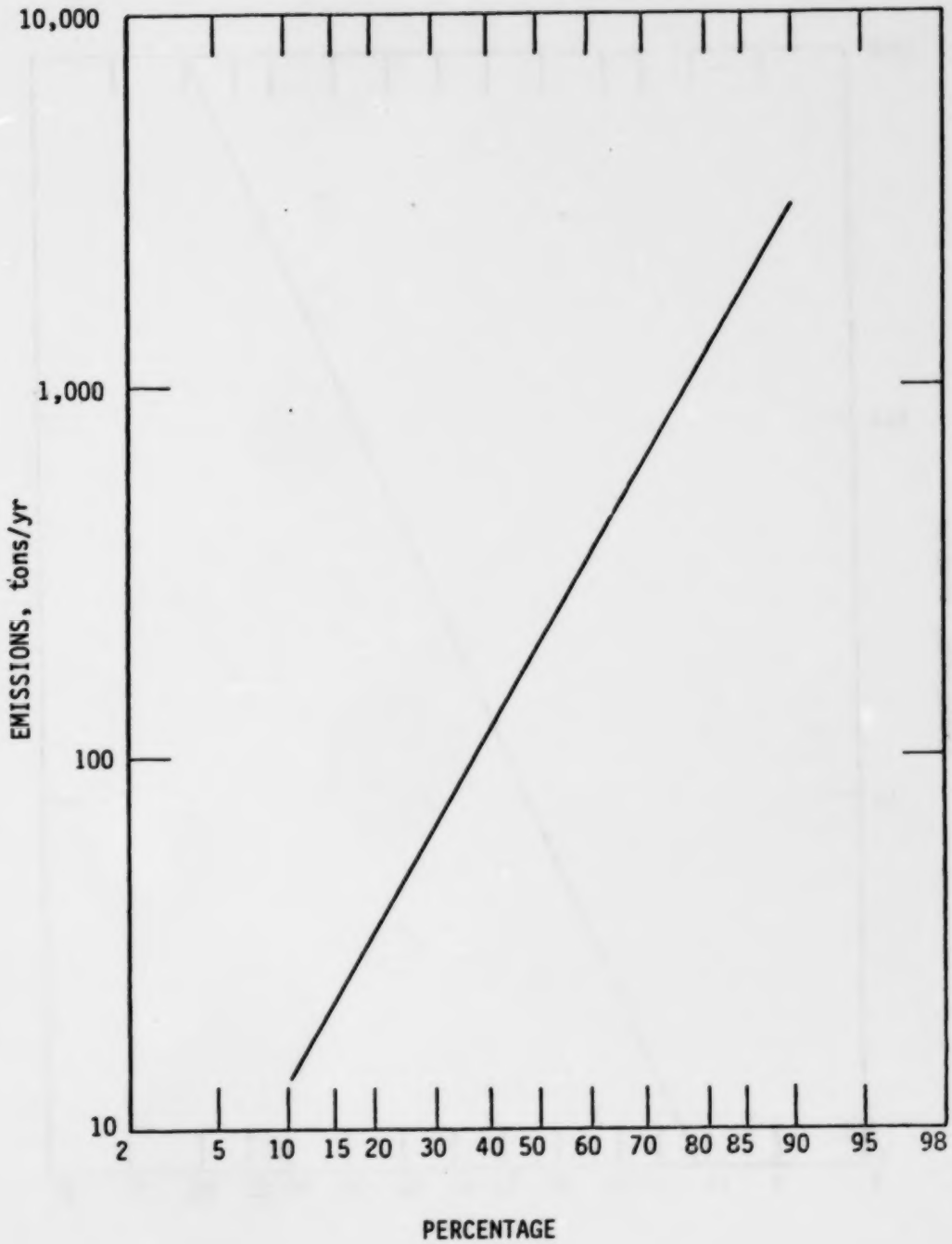

Figure 4. Distribution of sulfur oxide emissions for all sources used in the analysis.

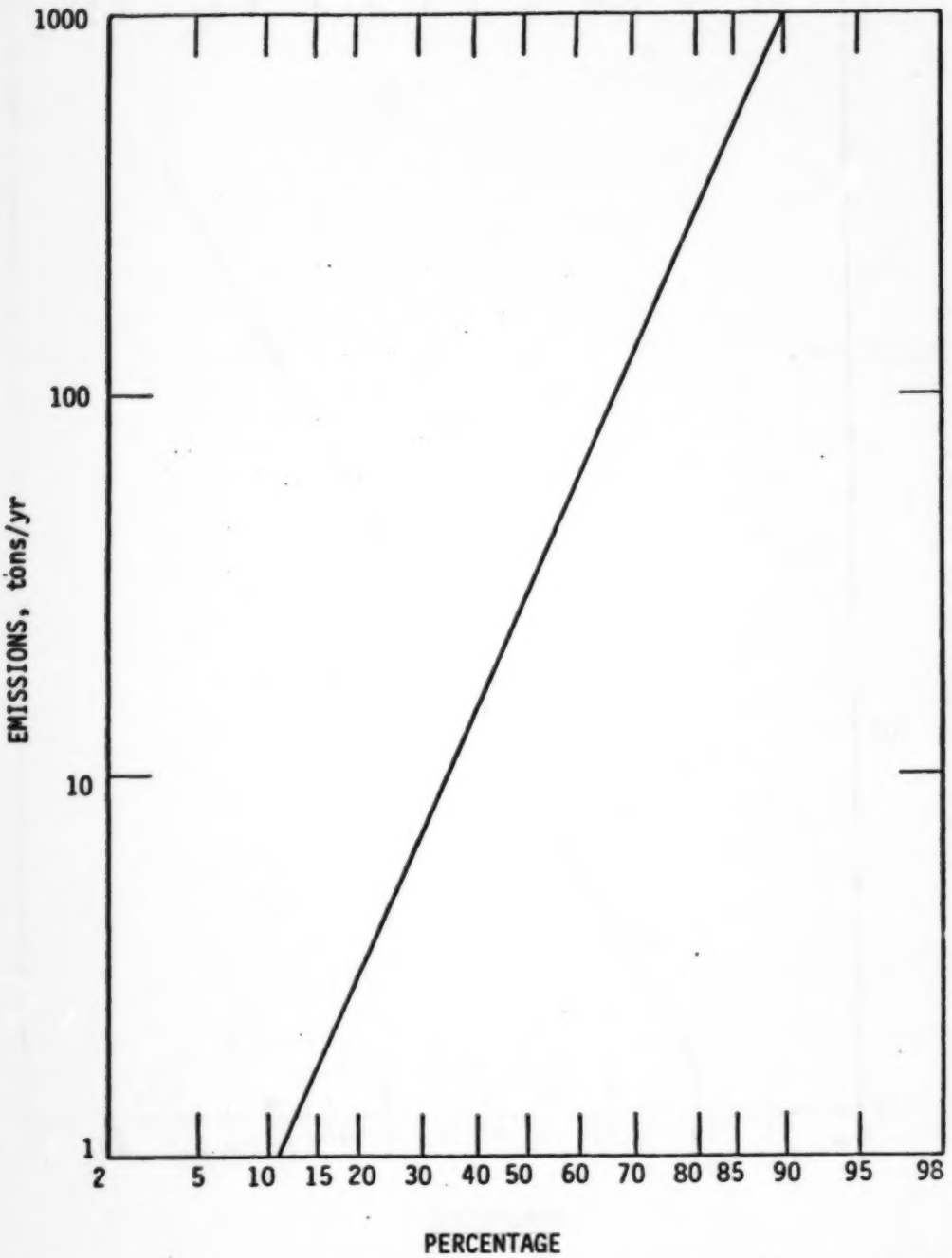

Figure 5. Distribution of carbon monoxide emissions for all sources used in the analysis.

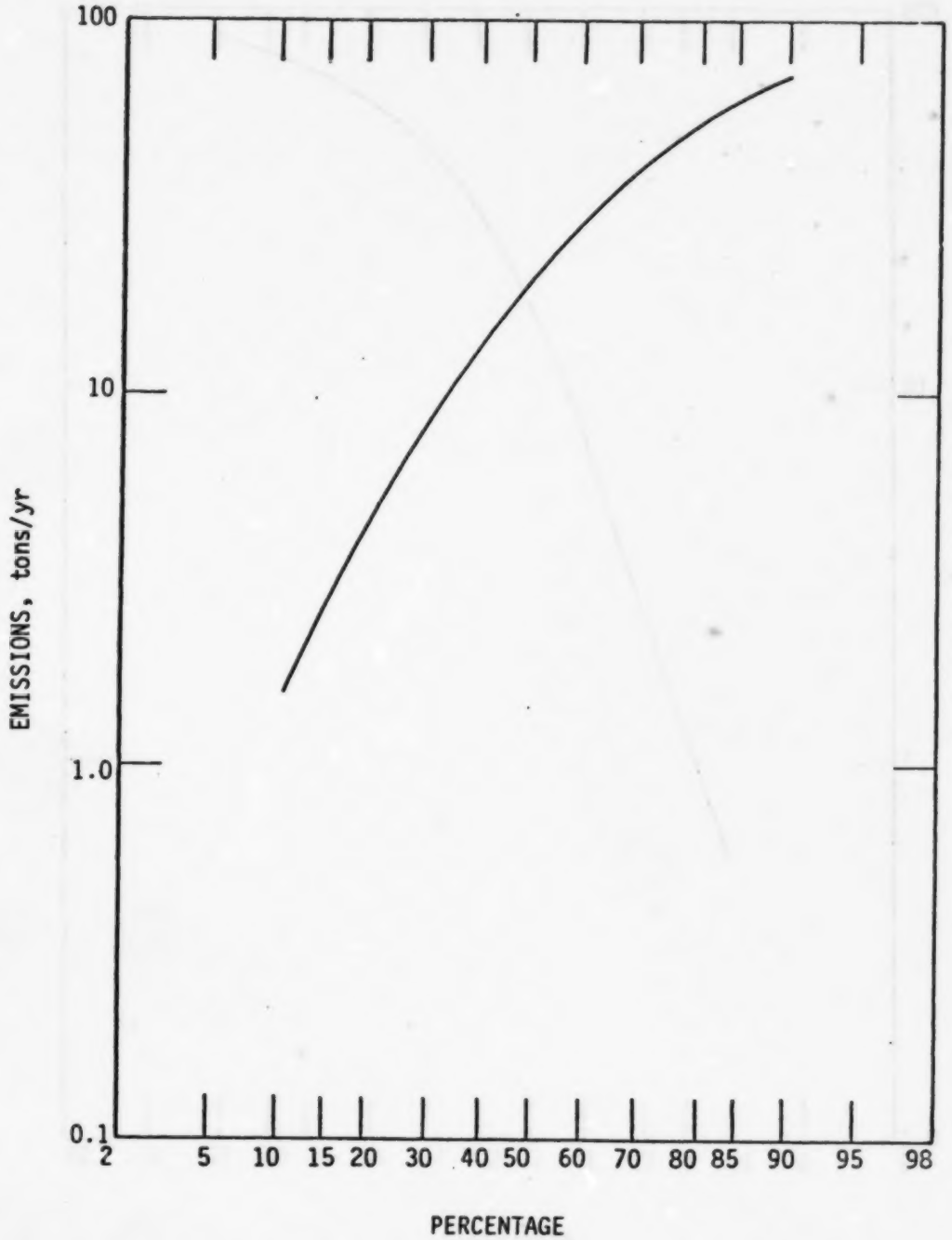

Figure 6. Distribution of particulate matter emissions for sources that emit less than 100 tons/yr.

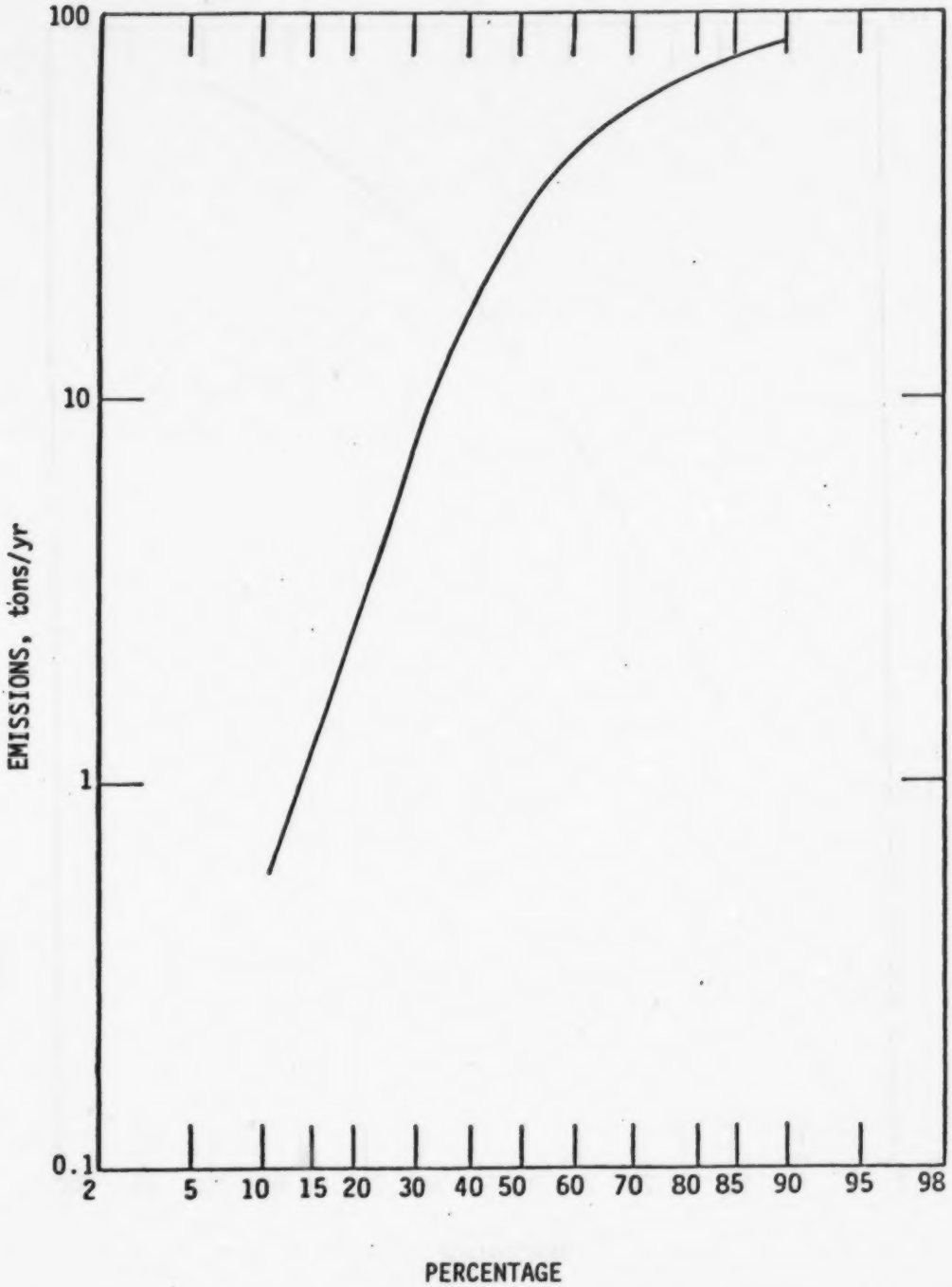

Figure 7. Distribution of nitrogen oxide emissions for sources that emit less than 100 tons/yr.

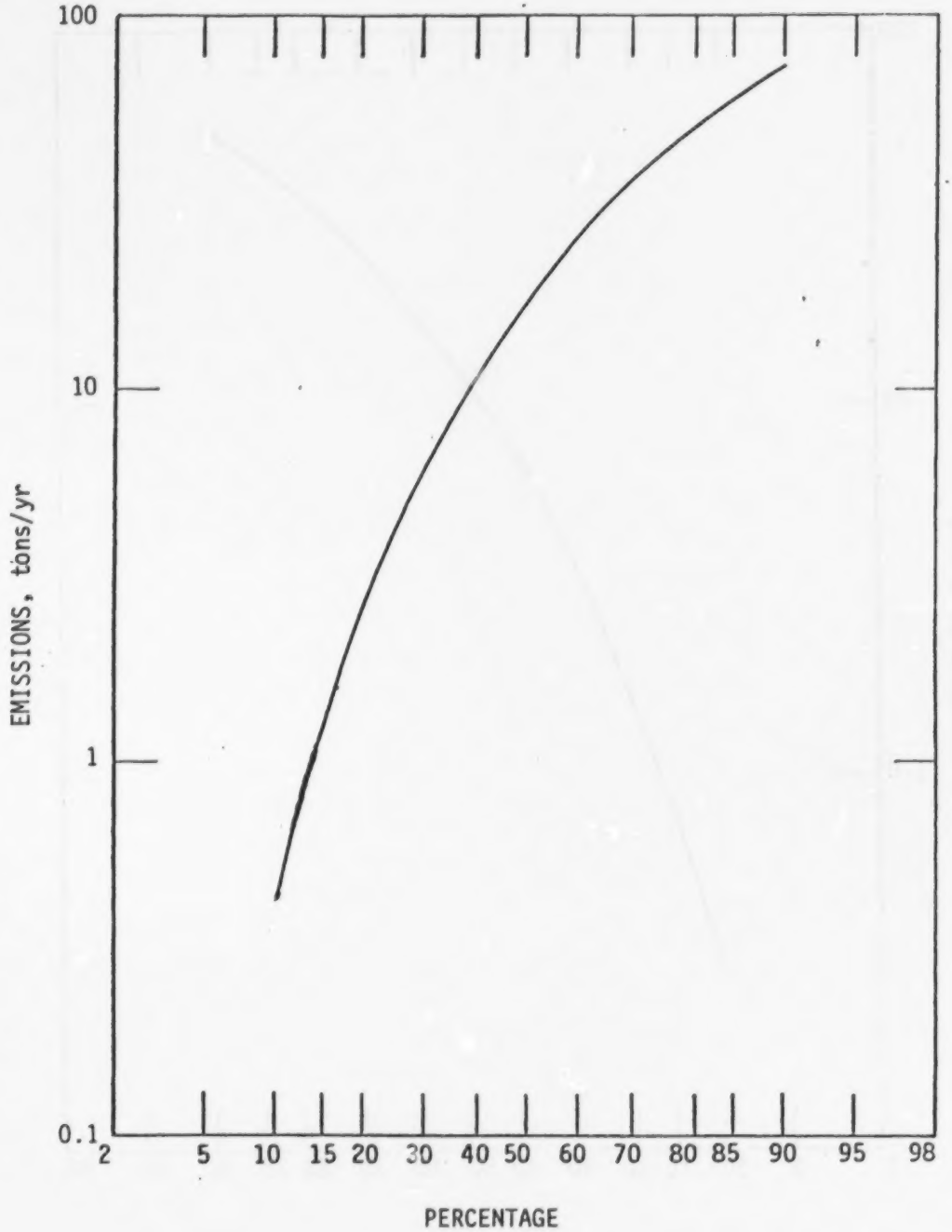

Figure 8. Distribution of sulfur oxide emissions for sources that emit less than 100 tons/yr.

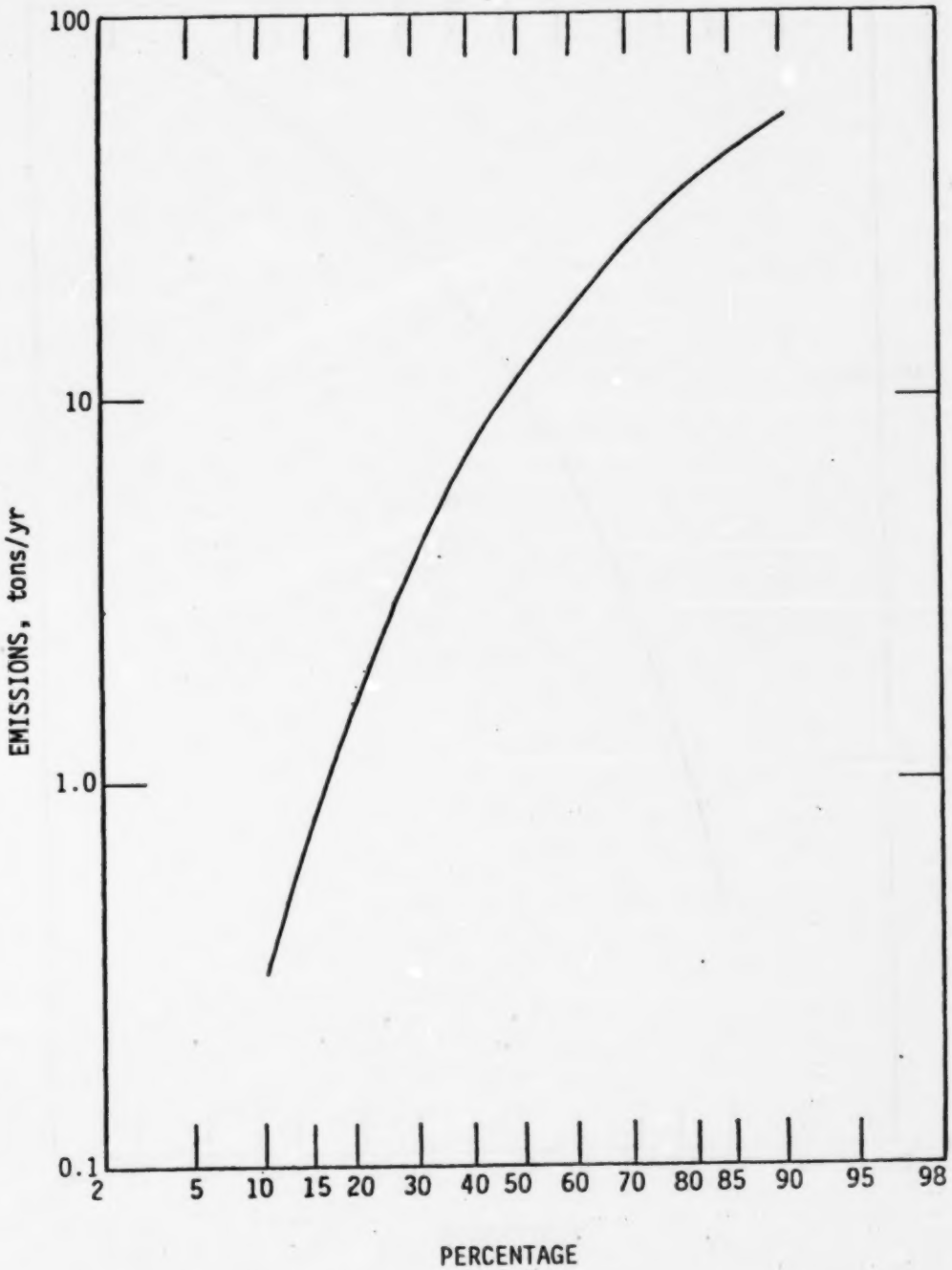

Figure 9. Distribution of carbon monoxide emissions for sources that emit less than 100 tons/yr.

TABLE 4. SELECTED PERCENTILE RANKINGS FOR CRITERIA POLLUTANT EMISSIONS FROM ALL SOURCES USED IN THE MODELING ANALYSIS

Pollutant	Tons/yr		
	10th percentile	50th percentile	90th percentile
NO_x	18	180	1500
SO_x	9	200	3000
PM	1	11.5	80
CO	0.6	30	1000

TABLE 5. SELECTED PERCENTILE RANKINGS FOR CRITERIA POLLUTANT EMISSIONS FROM SOURCES THAT EMIT LESS THAN 100 tons/yr

Pollutant	Tons/yr		
	10th percentile	50th percentile	90th percentile
NO_x	1	29	80
SO_2	0.45	12	85
PM	1.5	20	70
CO	0.29	10	55

percentile value ranges from 11.5 tons/yr for PM to 200 tons/yr for SO_x.

The 50th percentile value from the cumulative frequency distribution indicates that half the sources in the distribution would be greater than a certain value and half would be less. In the case of the sources making changes of less than 100 tons/yr, the 50th percentile value would indicate that half the sources in the sample would make emission changes of 15 tons/yr or less and half would make changes greater than 15 tons/yr. Likewise the 90th percentile value would indicate that 90 percent of the sources would be making changes of 75 tons/yr or less and 10 percent would be making changes of greater than 75 tons/yr.

Because major sources that make significant changes in their emissions (i.e., greater than 100/250 tons/yr) are clearly subject to PSD review by virtue of the Clean Air Act and the associated regulations, the major impact of the de minimis levels

will be on those major sources that make smaller, less significant changes in their emissions. In other words, depending upon where the de minimis levels are set, some sources would make emission changes that would be below these levels and therefore not be subject to PSD review. In the design of the de minimis analysis, a major emphasis is placed on those major sources making emission changes of less than 100 tons/yr. Therefore, only those sources that fall into this category were used in the analysis. If the full range of modified sources had been used, the assessment as pointed out by the data above would skew the results towards larger sources that would be basically unaffected by the de minimis levels in terms of whether they would be subject to PSD or not. This skewing of the impact toward the larger sources results from emissions varying significantly at the upper end of the distribution.

4.2 DISTRIBUTION OF ACTUAL STACK HEIGHTS

Figure 10 illustrates the distribution of actual physical stack heights used in the modeling studies. It should be noted that some sources had more than a dozen stacks. As illustrated in the figure, only 2 percent of all stacks were under 5 m and only 5 percent were more than 60 m. Half of the stacks ranged from 10 to 35 m, and 28 percent from 5 to 10 m. Thus, a large percentage of the stacks for the sources in the analysis were relatively short, but typical of the kind of sources that would be making changes of less than 100 tons/yr as a result of a modification to the source.

4.3 DISTRIBUTION OF EFFECTIVE STACK HEIGHTS

The PTMAX model uses the Briggs equation to calculate the final plume rise. The H′ is the height of the plume centerline when it becomes essentially level. Rarely will H′ correspond to the physical stack height. Calculations for plume rise are not necessarily valid within the first few hundred meters of the stack since the plume rise from a stack occurs over some distance downwind. Therefore, for the analysis, concentrations occurring less than 200 m from the source were eliminated from the data set (Section 3.4).

Figures 11, 12, and 13 show cumulative frequency distributions of H′ calculated by the Volume 10, Phase II method; by the adjusted Volume 10, Phase II method (i.e., precautionary values omitted and next highest value substituted); and at neutral conditions, D stability and a windspeed of 5 m/s, respectively. In Figures 14 and 15, the H′ data set used for the adjusted PTMAX runs was subdivided into a distribution of sources with pollutant emissions of more than 100 tons/yr and less than 100 tons/yr; the results of these distributions are summarized in Table 6. The mean H′ for sources with Q >100 tons/yr is 75 m; adding this data set to the sample with Q <100 tons/yr only raised the Q <100

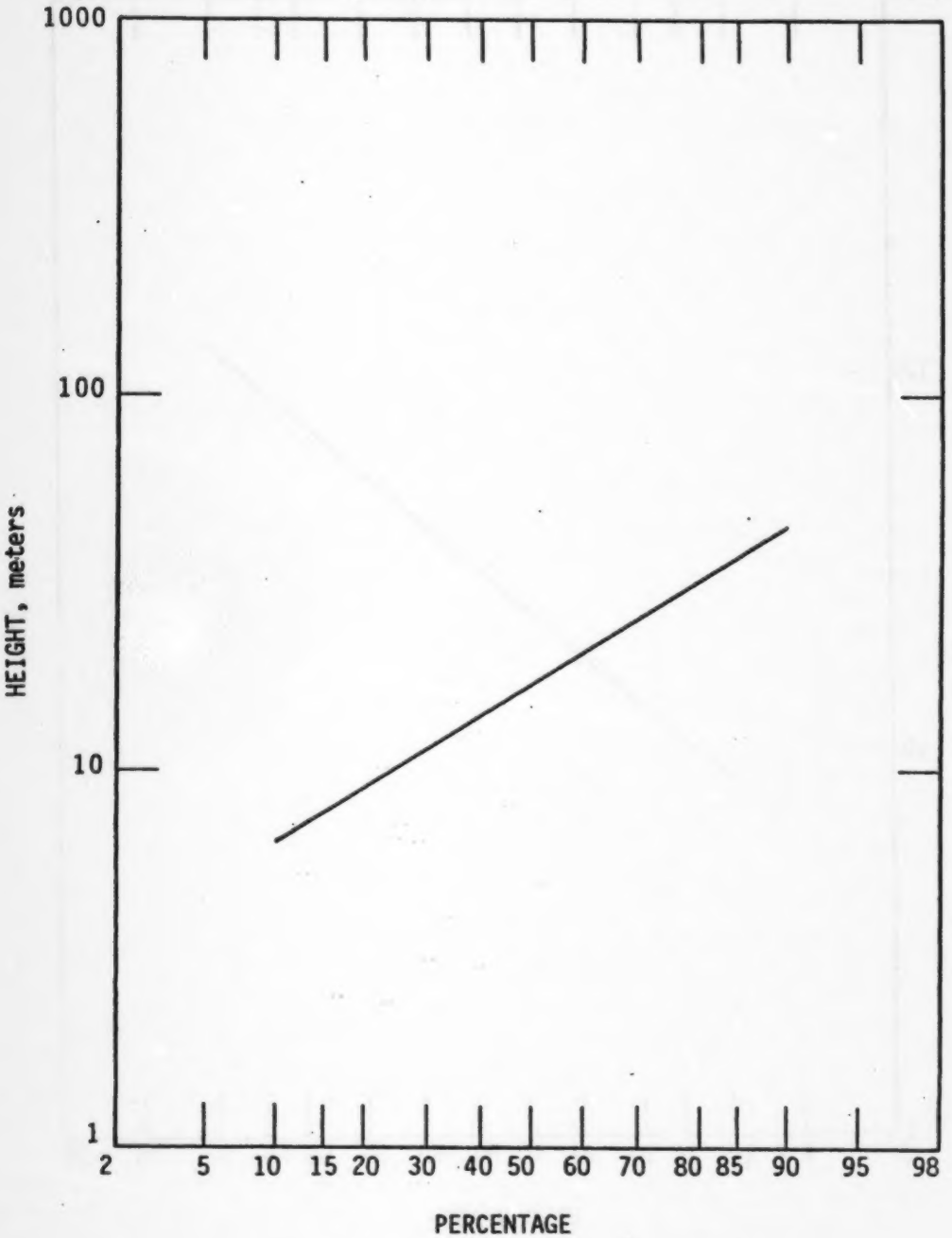

Figure 10. Distribution of actual stack heights.

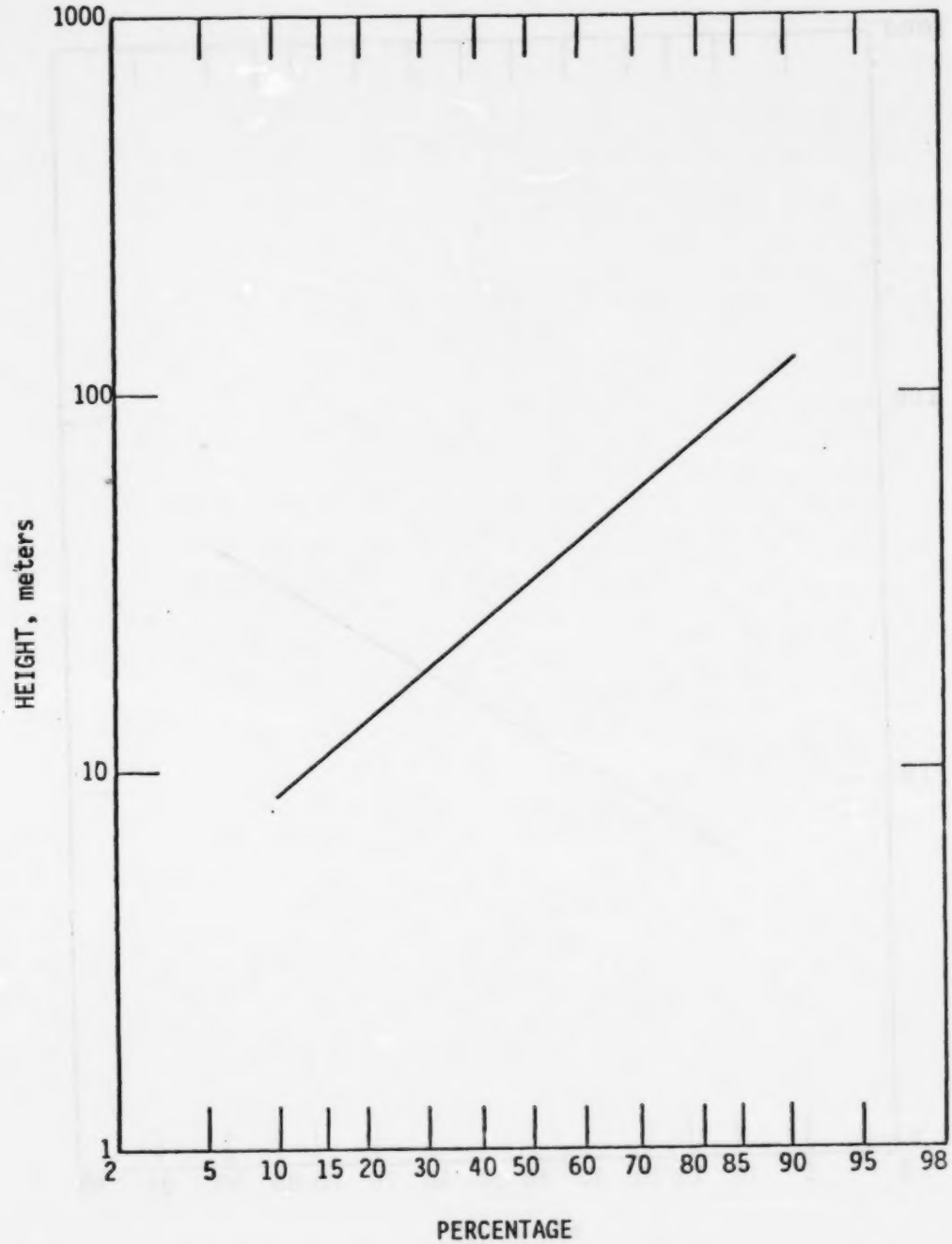

Figure 11. Distribution of effective stack heights--Volume 10 method.

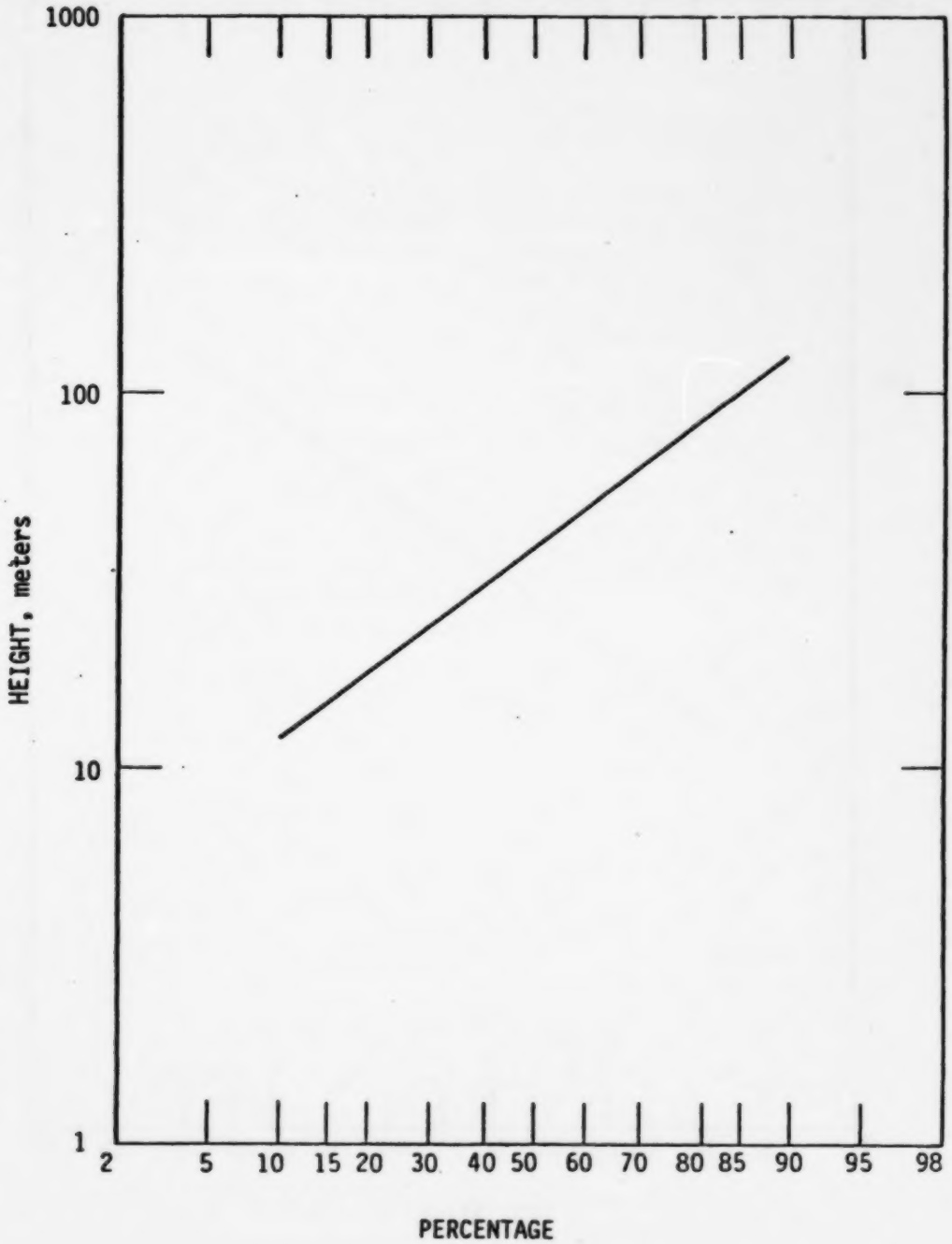

Figure 12. Distribution of effective stack heights--Volume 10 adjusted method.

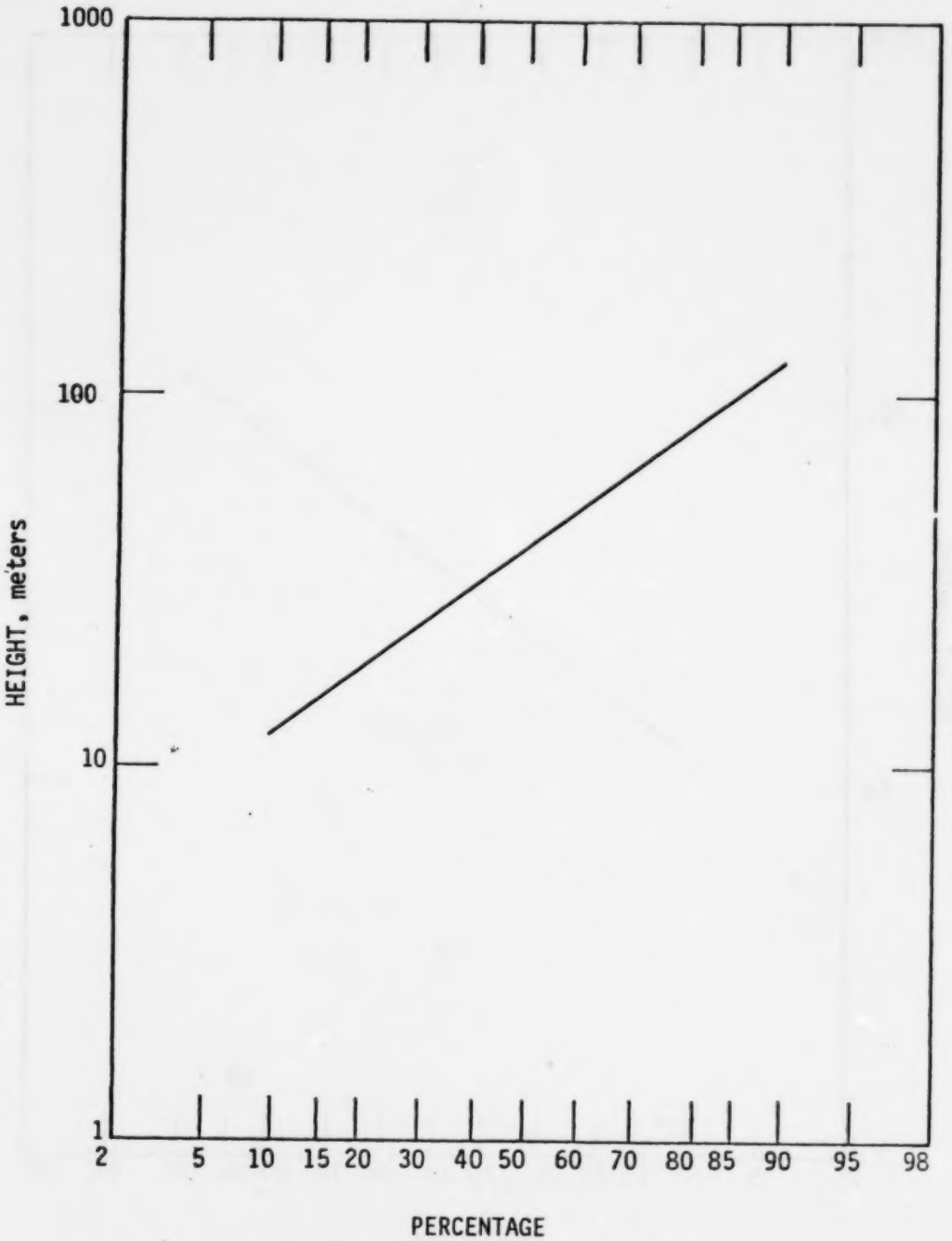

Figure 13. Distribution of effective stack heights--D stability and 5 m/s windspeed.

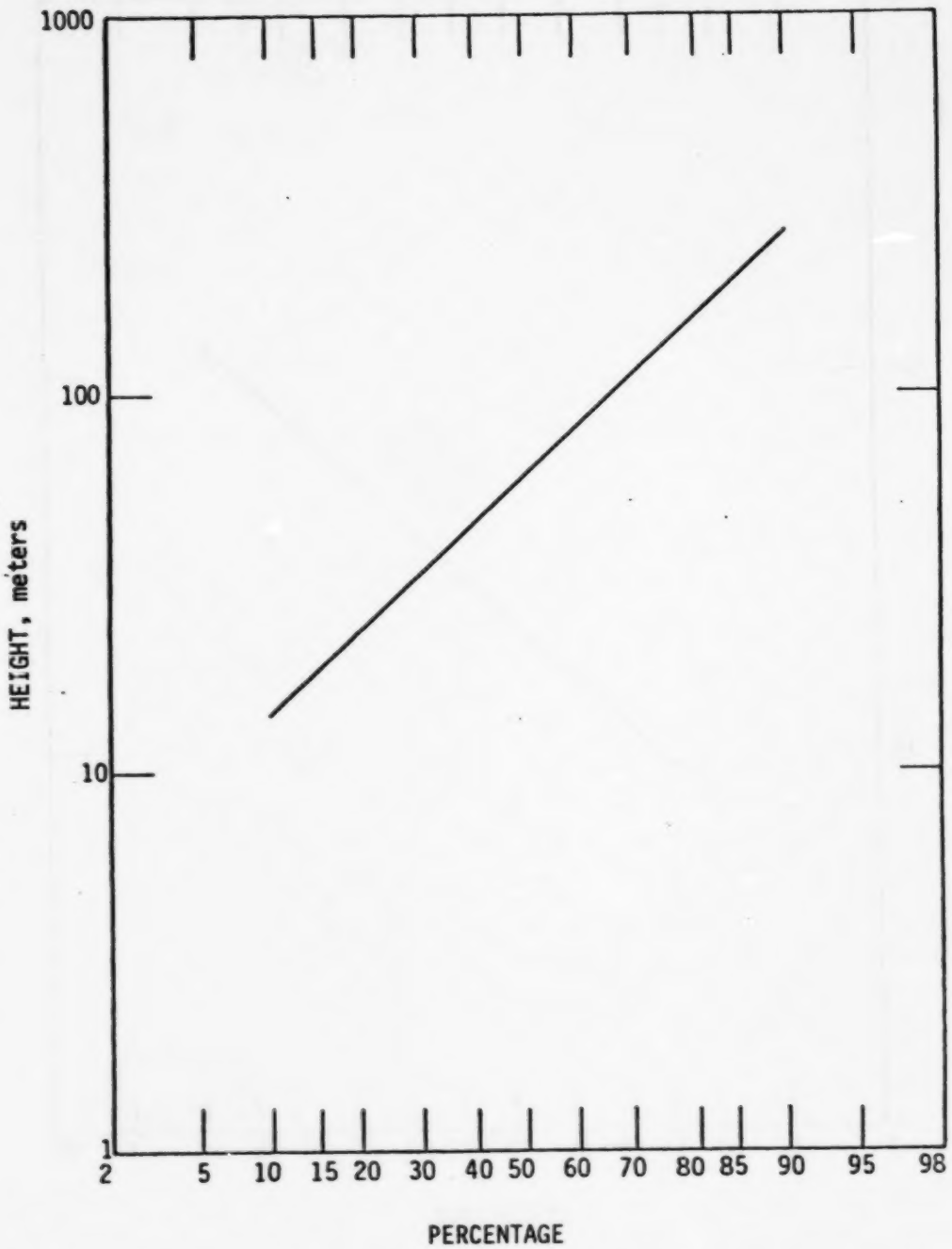

Figure 14. Distribution of effective stack heights--Volume 10 adjusted for sources that emit greater than 100 tons/yr.

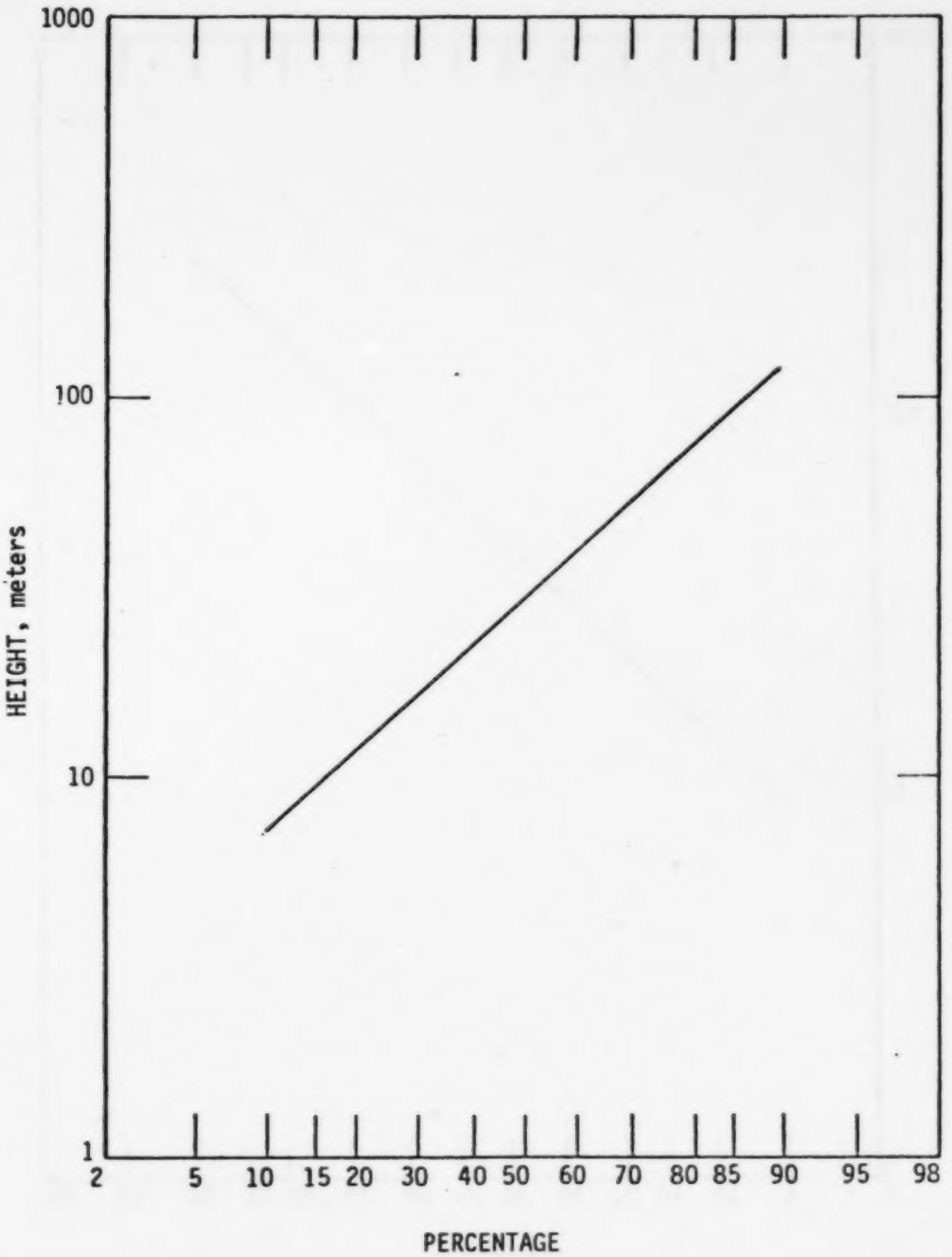

Figure 15. Distribution of effective stack heights--Volume 10 adjusted for sources that emit less than 100 tons/yr.

TABLE 6. EFFECTIVE STACK HEIGHTS CALCULATED BY THE PTMAX MODEL (meters)

Percentile	Vol. 10 method all sources[a]	Adjusted Vol. 10 method[b]			Neutral conditions[c] all sources
		All sources	Q <100 tons/yr	Q >100 tons/yr	
10th	10	13	13	14	12
50th	30	32	30	75	38
90th	112	142	122	183	115
Minimum stack height	4	6	6	4	5
Maximum stack height	185	28	176	286	286

[a]Precautionary values included in data set.

[b]Adjusted to eliminate any precautionary values (Section 3.3).

[c]Stability D, 5 m/s windspeed.

tons/yr mean H´ by 2 m because of the comparatively large number of modified sources applying for PSD permits with emission changes of <100 tons/yr. When the sources with Q >100 tons/yr were included, the 90th percentile value increased by 20 m, but the 10th percentile value remained the same.

As in the case of the emission changes, although the larger sources with emission changes of 100 tons/yr or more were fewer in actual number, because they vary widely at the upper end of the distribution, they tend to skew the distribution and ultimately the results toward the larger sources if they are included in the analysis.

4.4 DISTRIBUTION OF CONCENTRATIONS

To evaluate de minimis air quality concentrations, pollutant-specific concentration distributions were generated for all sources considered in the analysis. Figures 16, 17, 18, and 19 illustrate the distributions for 24-h concentrations of PM and SO_2, 8-h concentrations of CO, and annual averages of NO_2, respectively. These concentrations were estimated by using the PTMAX model (with precautionary values eliminated) and any additional modeling results available in the PSD permit files. Table

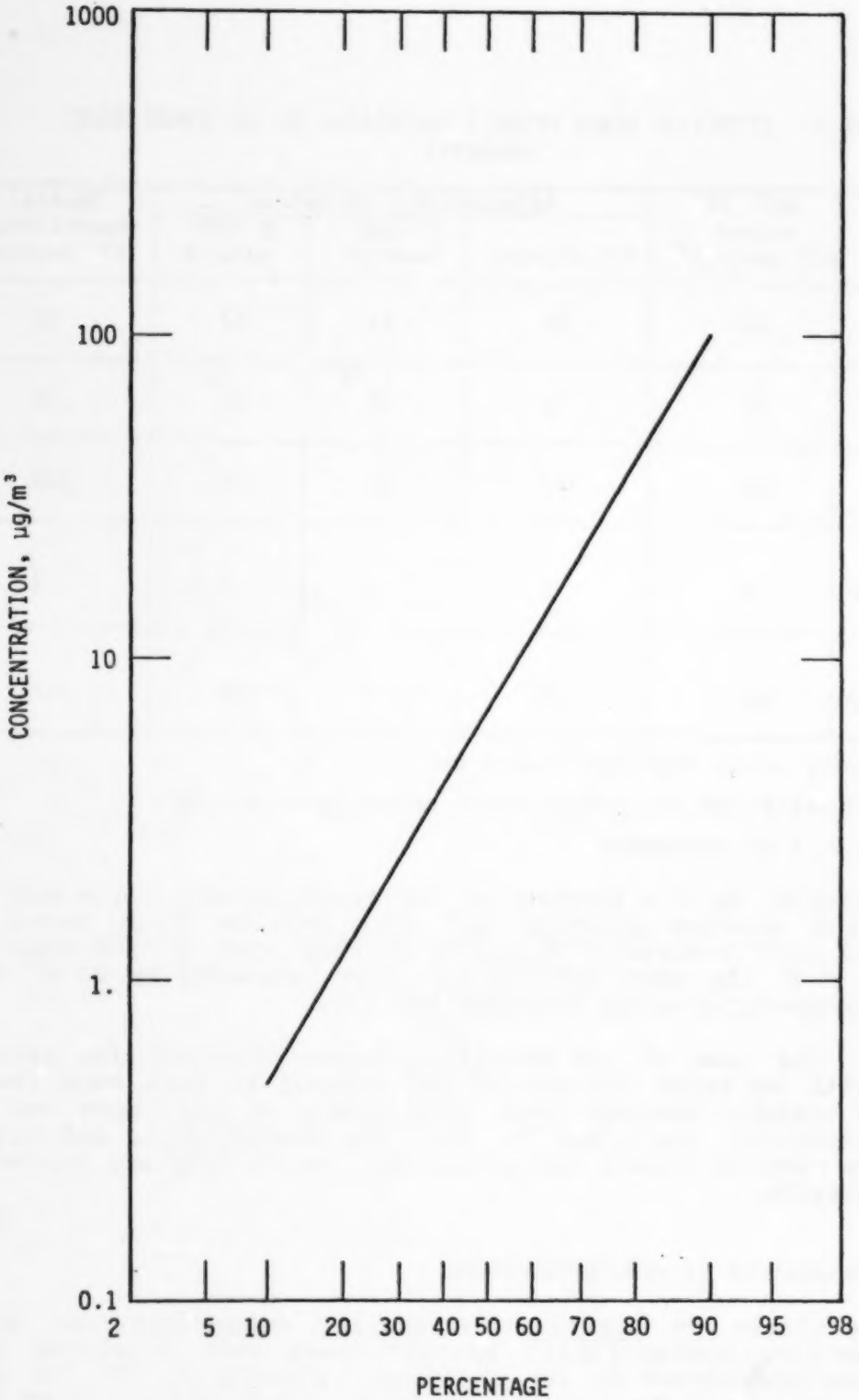

Figure 16. Distribution of TSP concentration using adjusted Volume 10 for sources that emit less than 100 tons/yr.

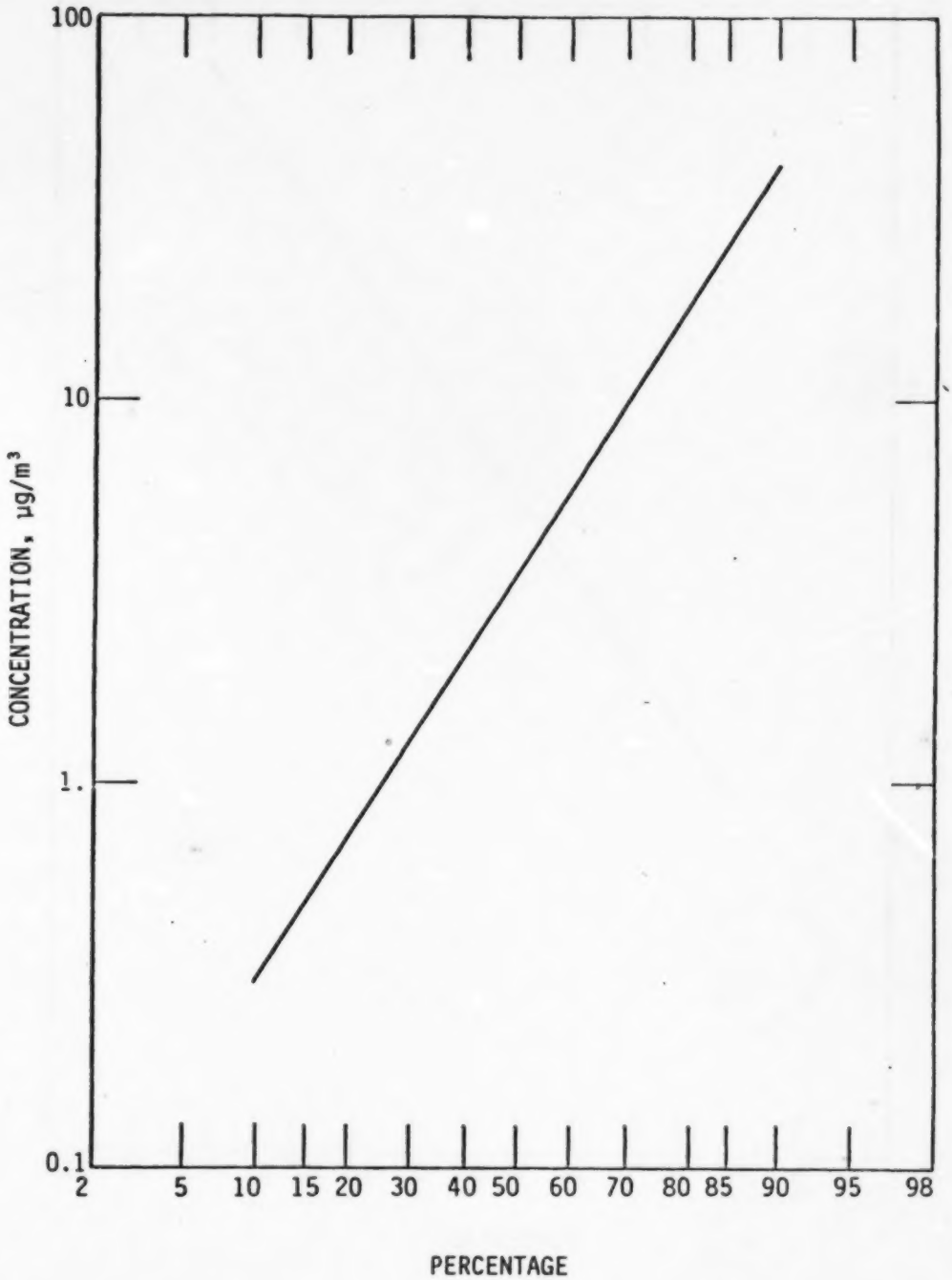

Figure 17. Distribution of SO_2 concentration using adjusted Volume 10 for sources that emit less than 100 tons/yr.

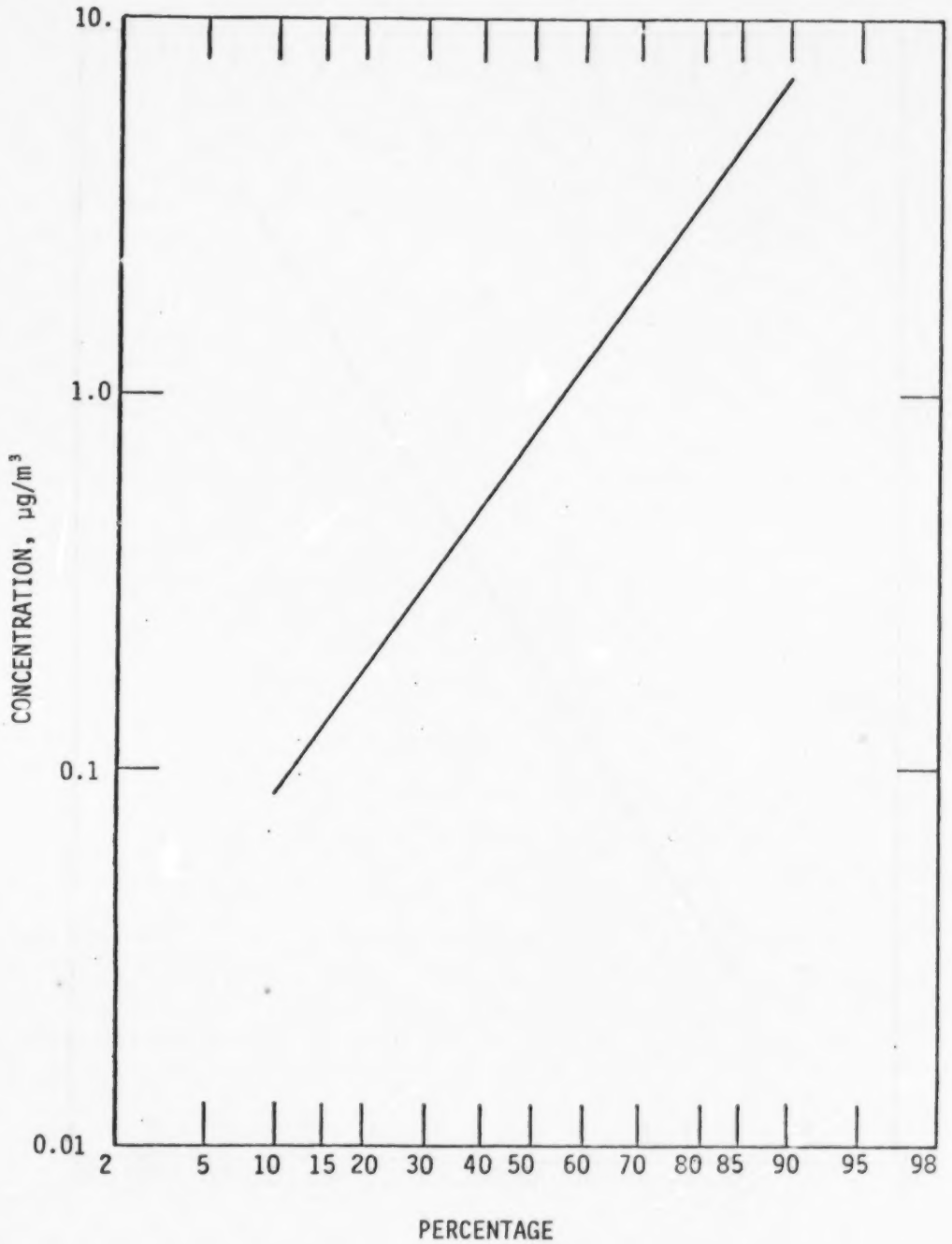

Figure 18. Distribution of NO_2 concentrations using adjusted Volume 10 for sources that emit less than 100 tons/yr.

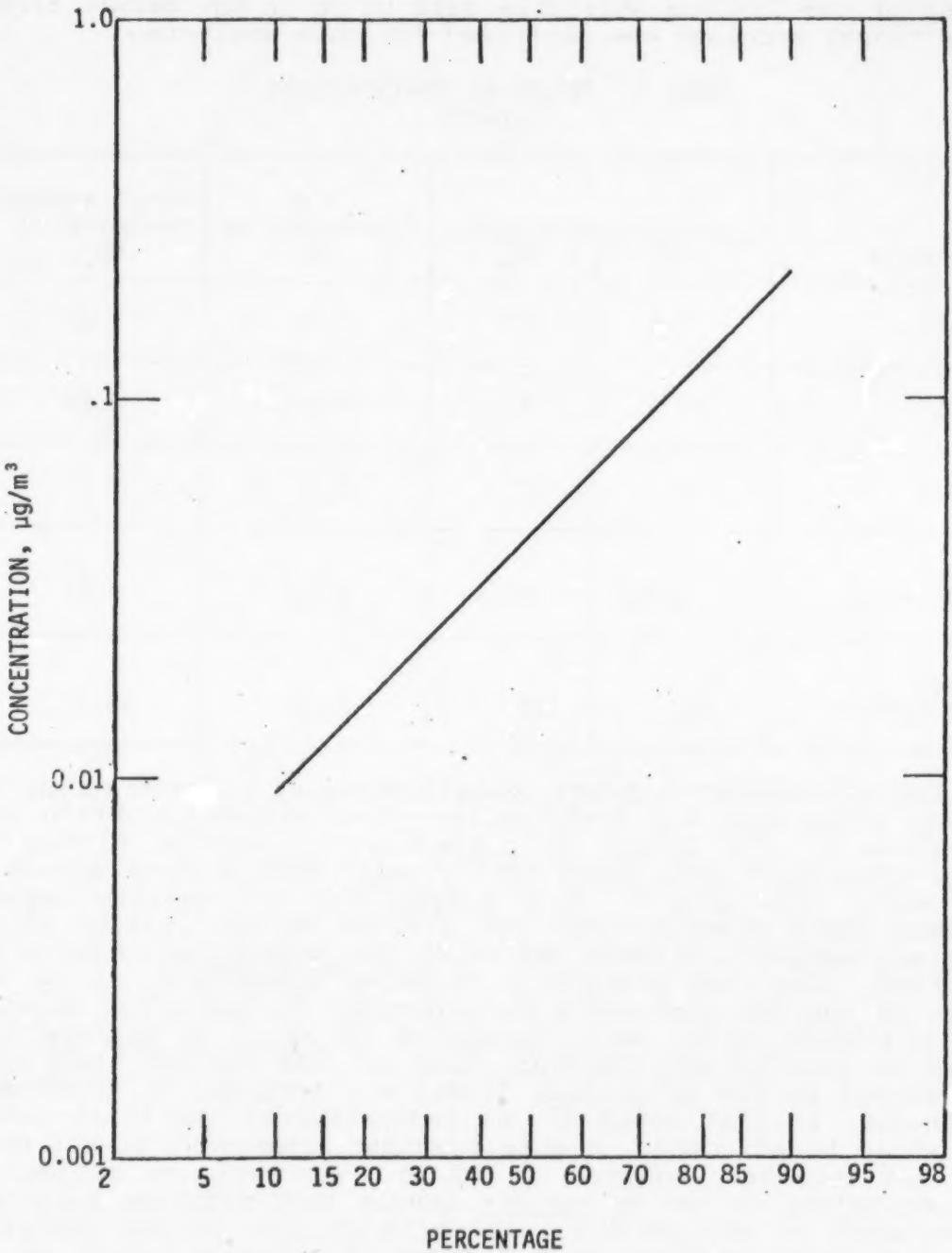

Figure 19. Distribution of CO concentrations using adjusted Volume 10 for sources which emit less than 100 tons/yr.

7 summarizes these concentrations and provides the minimum and maximum as well as mean values expected for each pollutant. Because of the limited available data on Pb in the permit files, no additional modeling was performed for this analysis.

TABLE 7. POLLUTANT CONCENTRATIONS
($\mu g/m^3$)

Percentile	24-h concentration		8-h concentration CO	Annual average concentration NO_x
	TSP	SO_2		
10th	0.5	0.3	0.009	0.09
50th	7	4.	0.05	0.85
90th	60	50	0.2	7.0
Minimum concentration	0.01	0.12	0.005	0.03
Maximum concentration	622	129	0.286	10.3

The cumulative frequency distributions of concentrations can be used along with the distribution of emissions to obtain some indication of the number or percentage of sources within the sample population that would emit greater than a given amount or that would have greater than a specified air quality impact. Although these distributions are limited to the sources within the given sample of sources for which the de minimis analysis was performed, they can provide a relative assessment as to the number of sources that would be affected if a specified emission or air quality level were designated as being de minimis. It should be pointed out, however, that not all sources that would be affected by the de minimis levels are included in these distributions, so they would not be indicative of the total number that would be affected. A more complete assessment of all those that are currently subject to PSD or that would be subject to PSD, depending on the de minimis levels that might be selected, is provided in Section 4.8. The main purpose of the distributions was to ensure that a full range of emission levels or air quality concentrations was considered in the de minimis analysis and that the analysis was based on these typical sources expected to make small emission changes over the course of a year.

4.5 EMISSIONS ASSOCIATED WITH SPECIFIC AIR QUALITY LEVELS

Pollutant-specific ratios χ/Q of pollutant concentrations (χ) and their corresponding mass emission rates (Q) were generated for TSP, SO_2, NO_x, and CO by the use of the χ values from modeling results contained in PSD permit files and the χ values estimated by Volume 10, Phase II, PTMAX modeling with precautionary values adjusted following the procedure listed in Section 3.4. To avoid a skewed distribution, sources with mass emission rates greater than 100 tons/yr were also eliminated from the χ/Q data set because they would not be representative of emission changes that would be affected by the de minimis exemption. Even after these precautionary values were adjustable, a sample size of greater than 25 data points was available for all criteria pollutants concerned, i.e., TSP, SO_2, CO, and NO_x. Because of deposition problems with Pb, the χ/Q ratio was generated by a separate methodology (Section 3.4).

Figures 20 through 23 represent the pollutant-specific χ/Q plots generated from adjusted Volume 10, PTMAX data, and modeling results from permit files for sources with emission changes <100 tons/yr. The mean 50th percentile value for each pollutant was divided into the respective values being considered for de minimis limits to determine the associated mass emission rate. For example, the 50th percentile χ/Q for TSP is 0.43 (Figure 20). Dividing 7.8 $\mu g/m^3$ (3% of the NAAQS) by 0.43 yields an associated emission rate of approximately 18 tons/yr. For TSP and SO_2, various percentages of the primary standard (2 through 5%) and percentages of the Class II increment (10 and 20%) were evaluated. The same percentage range of the annual standard was evaluated for NO_x. In the case of CO, one percent of the standard yielded a corresponding emission rate of greater than 100 tons/yr; therefore, further evaluation of other percentages was not necessary. Table 8 lists the Q values estimated by this analysis for TSP, SO_2, CO, and NO_x by use of the 50th percentile mean χ/Q values. These values are pollutant-averaging time specific--24-h for TSP and SO_2, 8-h for CO, and an annual average for NO_x.

The χ/Q for Pb was constructed by use of EPA modeling results,[5] and a χ/Q distribution (Figure 24) was generated, which yielded a 50th percentile value of 0.1. This value can be used in the same manner as the χ/Q's for TSP, SO_2, CO, and NO_x. An air quality value equal to 5 percent of the standard (0.075 $\mu g/m^3$) would therefore be associated with a Q of 0.75 ton/yr.

Since no air quality standard exists for HC and since NO_x and VOC are interrelated in the formation of ozone, results from the NO_x analysis were used for VOC (O_3) de minimis determination.

In addition to the pollutant-specific χ/Q distribution, a distribution including the χ/Q values for all pollutants was constructed (Figure 25) so that the χ/Q concept could be used to obtain emission rates from air quality impact estimates associated with noncriteria pollutants. The combined-pollutant χ/Q

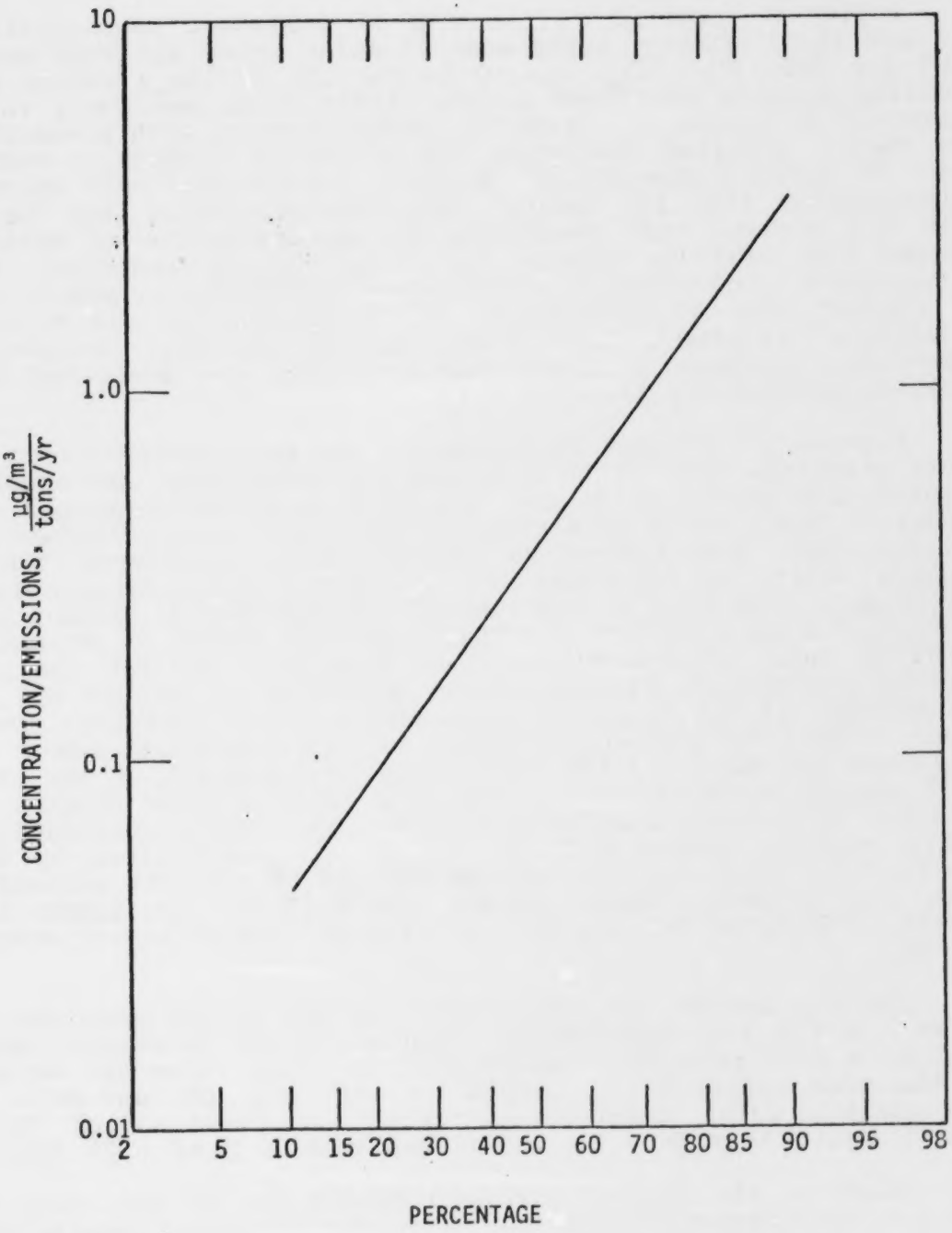

Figure 20. Distribution of concentration/emission for TSP.

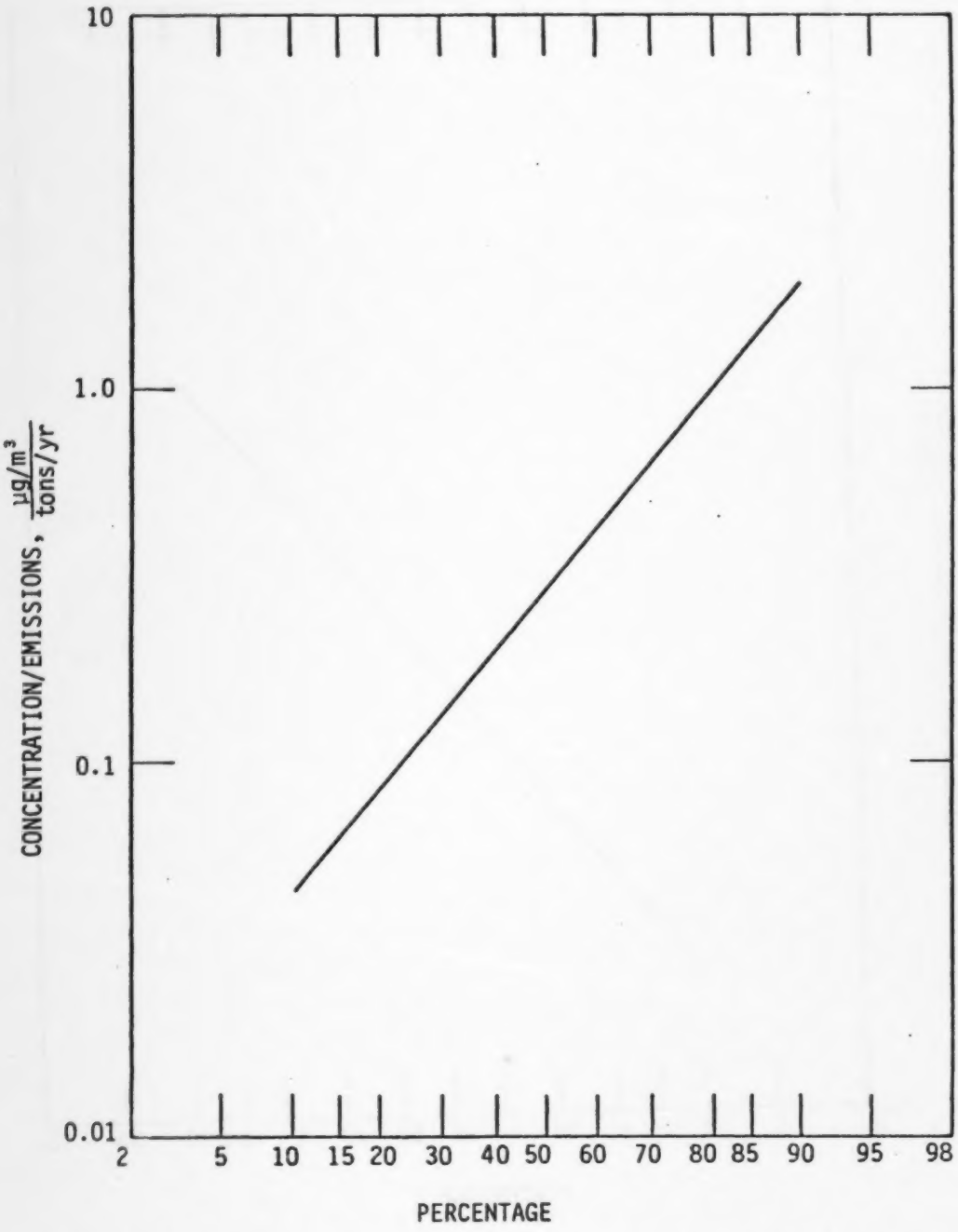

Figure 21. Distribution of concentration/emission for SO_2.

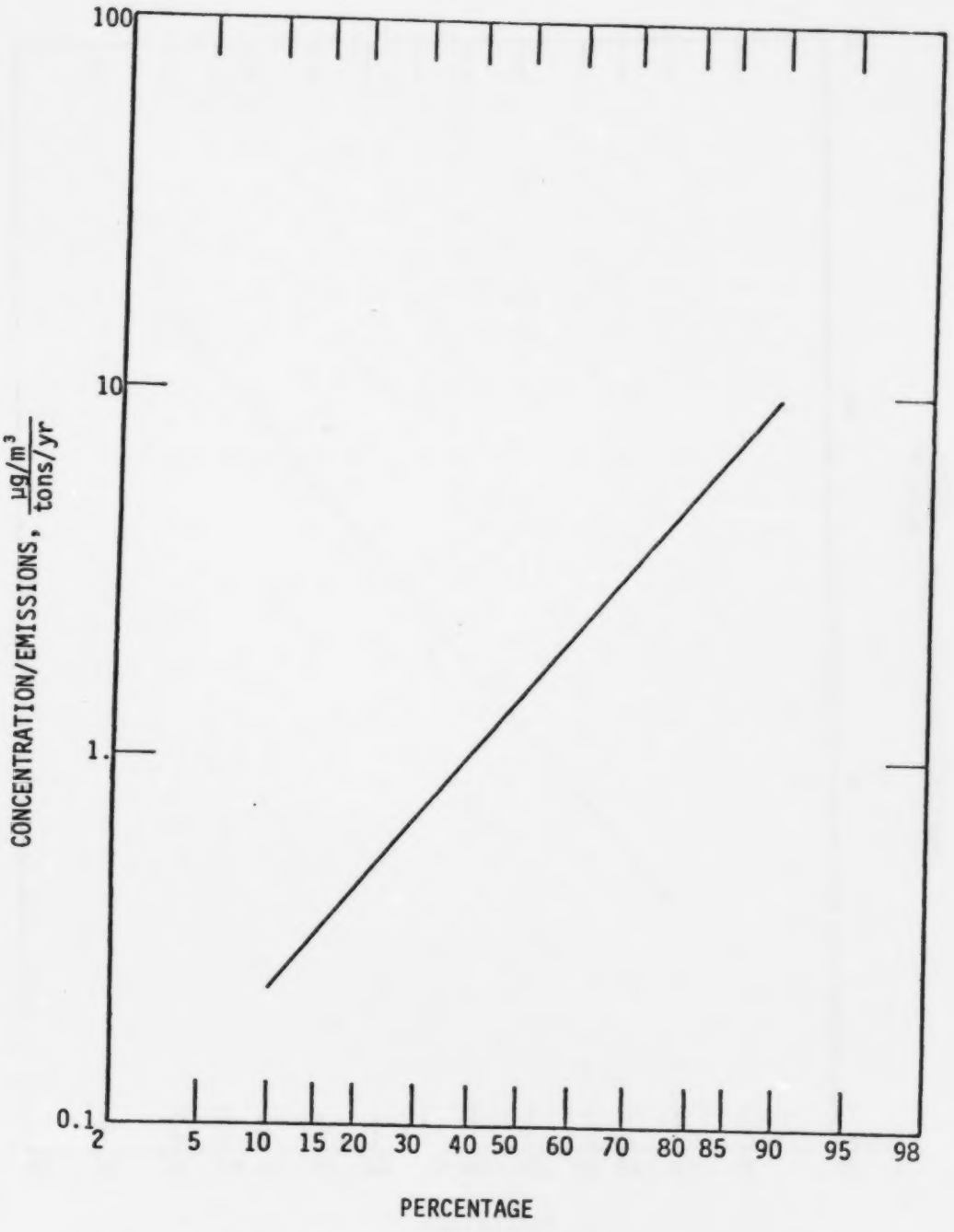

Figure 22. Distribution of concentration/emission for NO_2.

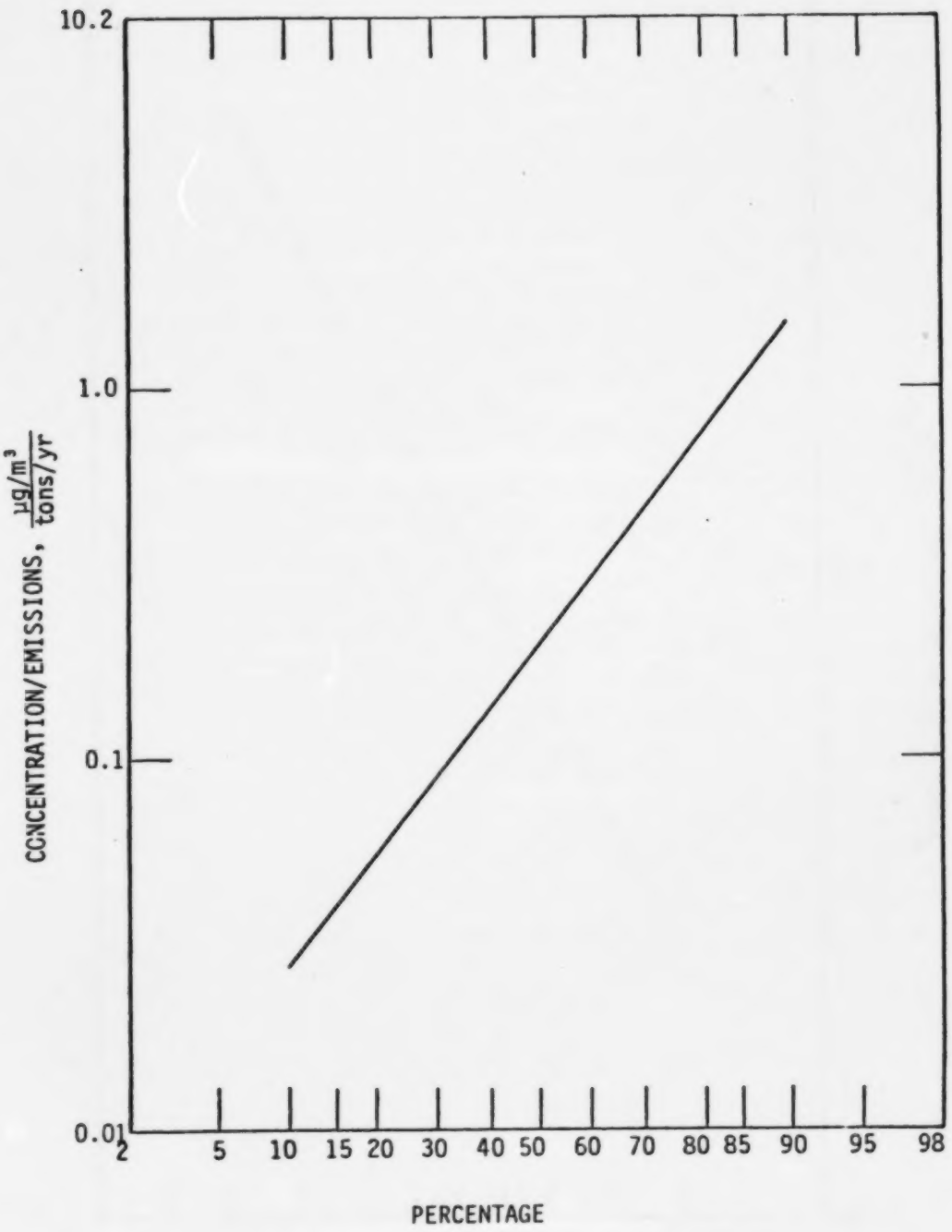

Figure 23. Distribution of concentration/emission for CO.

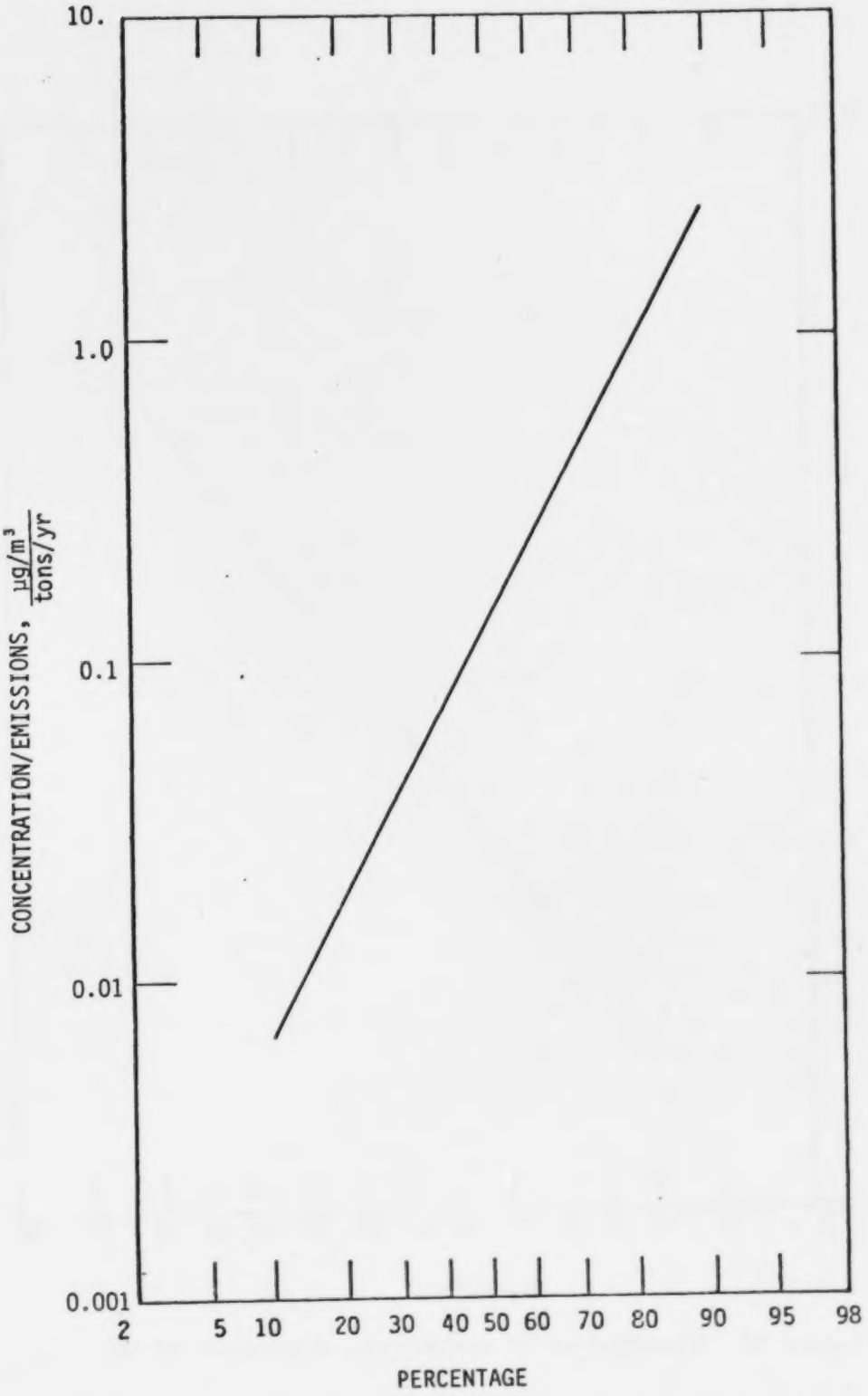

Figure 24. Distribution of concentration/emission for Pb.

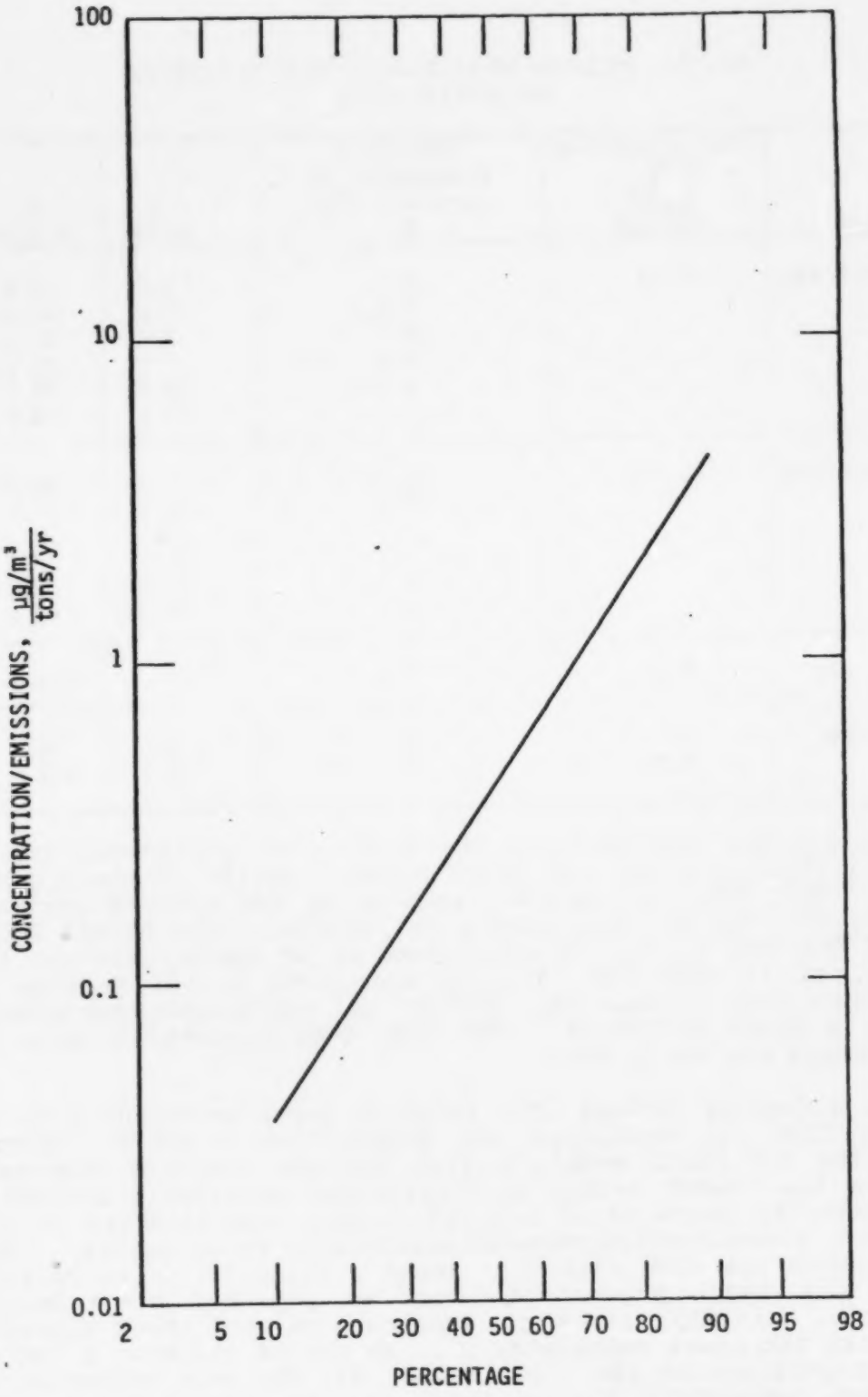

Figure 25. Distribution of concentration/emission for CO, SO_2, and TSP combined.

TABLE 8. EMISSION RATES ASSOCIATED WITH SELECTED AIR QUALITY LEVEL

Pollutant	50th percentile χ/Q, $\frac{\mu g/m^3}{tons/yr}$	Percent of standard(S) or increment (I), %	χ, $\mu g/m^3$	Q, tons/yr
TSP, 24-h avg	0.43	10 I	3.7	8.6
		2 S	5.2	12.1
		20 I	7.4	17.2
		3 S	7.8	18.1
		4 S	10.4	24.2
		5 S	13.0	30.2
SO_2, 24-h avg	0.385	2 S	7.3	18.9
		10 I	0.1	23.6
		3 S	10.9	28.3
		4 S	14.6	37.9
		20 I	18.2	47.3
		5 S	18.3	47.5
CO, 8-h avg	0.23	1 S	100	435
NO_x, annual avg	0.05	2 S	2.0	40
		5 S	5.0	100

distribution was evaluated for the noncriteria pollutants instead of a pollutant-specific χ/Q distribution similar to those generated for TSP, SO_2, CO, and NO_x because of the limited available modeling data for the noncriteria pollutants in the permit files. The χ/Q for all pollutants was deemed to be appropriate for this purpose, as it uses the ratio of emissions to air quality for each source and, in this way, factors out any unique characteristics of a given pollutant. The mean 50th percentile value for the combined χ/Q was 0.325.

An alternate method for relating mass emission rate and concentration was developed for comparative purposes (Section 3.5). The EPA PTDIS model, a flat terrain Gaussian dispersion model in the UNAMAP series that estimates short-term concentrations directly downwind of a point source, was selected to predict the concentration-mass-emission-rate relationship. This model allows the user either to input a value for H′ or to enter the various stack parameters, such as physical stack height, stack exit velocity, stack gas temperature, and stack diameter, from which the model calculates H′. By use of the mean H′ of the sample population as the input value, all the mean values of the key stack parameters listed above can be considered as they relate to a specific H′ instead of separate nonassociated average values.

The mass emission rates associated with selected de minimis air quality levels can be calculated by dividing the selected de minimis air quality values by the concentrations estimated by the PTDIS model. The 50th percentile of the H′ distribution calculated by the PTMAX model (by use of the adjusted Volume 10 Phase II approach as described in Section 3.4), was input the PTDIS model along with stability-windspeed combinations used in the PTMAX model. Each combination of stability and windspeed was run until a maximum concentration and a corresponding "worst case" condition were identified. This value is the pollutant concentration associated with each ton of emission emitted and can be used to calculate the emissions associated with a given air quality value. The results of this analysis are presented in column Q_2 of Table 9.

TABLE 9. EMISSION RATES ASSOCIATED WITH SELECTED AIR QUALITY LEVELS ARRIVED AT BY SEVERAL MODELING TECHNIQUES

Pollutant	χ, $\mu g/m^3$	Tons/yr			
		Q_1[a]	Q_2[b]	Q_3[c]	Q_4[d]
TSP	10.4	24.2	3.7	25.7	19.3
SO_2	14.6	37.9	5.1	36.1	27.2
CO	100	435	35.2	247.5	186
NO_x	2	40	5	35	26.1

[a] χ/Q relationship.

[b] PTDIS modeling using H′ = 30 m, calculated from "worst case" stability class and windspeed analysis combined with "worst case" conditions to calculate concentration.

[c] PTDIS modeling using H′ = 40 m, D stability, and windspeed of 5 m/s.

[d] PTDIS modeling using H′ = 30 m, D stability, and windspeed of 2 m/s.

A second approach was developed, which repeats this procedure but uses the H′ from the neutral condition values calculated by the PTMAX model (Section 3.4). This approach used the PTDIS model with D stability and a windspeed of 5 m/s, since this is the combination of conditions for which the average H′ was calculated. These results are more representative than those calculated by the previous technique because the original PTMAX analysis and the PTDIS runs would be conducted under the same consistent meteorological conditions. The results of this approach are presented in column Q_3 of Table 9.

In the same manner, an H′ of 30 m, D stability, and 2 m/s windspeed were input into the PTDIS model to duplicate conditions originally used by EPA in the initial de minimis analysis, but in

this case a more refined modeling technique was used. The results of these calculations are presented in column Q_4 of Table 9.

4.6 URBAN AREA AIR QUALITY IMPACT DUE TO DE MINIMIS CHANGES IN EMISSIONS

To obtain an indication of the regional impact of major sources making de minimis changes, the urban version of the RAM model was run for 37 actual stationary sources of SO_2 in a midwestern metropolitan area. The locations of these sources, along with their particular source characteristics, were input into the model (Table 10). The source strength for all sources was reduced to unity so that each source would equally impact the spacing of the honeycomb grid established by the model for the area. Once the base case had been established, it was assumed that each source would be modified by a specific amount and the incremental change in air quality concentration would be calculated for the 45 receptors spread across the metropolitan area.

The results of this modeling effort are shown in Table 11. The maximum change in the 24-h concentration from all sources making a 50-ton/yr change would be 1.5 $\mu g/m^3$. A 25-ton/yr change would be approximately 0.75 $\mu g/m^3$. Thus, on an urbanwide basis the overall air quality change associated with 37 sources making a de minimis change of 50 tons/yr would be slightly above the significant levels set forth in the June 19, 1978, PSD regulations (43 FR 26398).

TABLE 11. RESULTS OF URBANWIDE AREA MODELING OF SELECTED DE MINIMIS LEVELS

	10 tons/yr	25 tons/yr	40 tons/yr	50 tons/yr
Max aggregrated χ from sig. pt. sources $\mu g/m^3$	0.21	0.53	0.85	1.1
Max aggregrated χ from all sources $\mu g/m^3$	0.30	0.75	1.2	1.5

4.7 CLASS I AREA PROTECTION

Under the Clean Air Act, clean areas of the Nation could be designated under one of three classes, which permit varying degrees of air quality deterioration. Allowable increments of air pollution were established for each class at a level that was considered significant for that area. Because the Class I increment permitted the least air quality deterioration, a modeling

TABLE 10. POINT-SOURCE INPUT DATA FOR REGIONAL AIR QUALITY ANALYSIS

POINT SOURCE LISTING

SOURCE	EAST COORD (USER UNITS)	NORTH COORD (USER UNITS)	SO2(G/SEC) EMISSIONS	PART(G/SEC) EMISSIONS	STACK HT(M)	STACK TEMP(K)	STACK DIAM(M)	STACK VEL(M/SEC)
1	739.00	4401.70	.72	.00	61.00	422.00	2.40	4.10
2	739.00	4401.70	.72	.00	61.00	422.00	2.40	8.00
3	739.00	4401.70	.72	.00	61.00	422.00	2.40	5.10
4	739.00	4401.70	.72	.00	61.00	422.00	2.40	4.60
5	744.10	4399.80	.72	.00	18.60	606.00	1.50	8.90
6	744.10	4399.80	.72	.00	18.60	551.00	1.50	8.20
7	733.60	4410.30	.72	.00	38.10	519.00	1.80	2.70
8	742.00	4405.00	.72	.00	26.50	505.00	1.00	3.80
9	736.70	4403.50	.72	.00	53.40	450.00	2.30	8.80
10	736.70	4403.50	.72	.00	53.40	436.00	2.30	5.80
11	735.40	4394.50	.72	.00	67.10	455.00	3.10	3.60
12	737.00	4394.70	.72	.00	30.50	444.00	1.80	9.80
13	737.00	4394.70	.72	.00	36.60	433.00	2.60	6.40
14	743.00	4402.20	.72	.00	53.30	561.00	2.00	4.00
15	738.20	4397.00	.72	.00	61.00	450.00	3.10	12.40
16	738.20	4397.00	.72	.00	61.00	450.00	3.10	12.10
17	739.80	4403.00	.72	.00	21.30	478.00	1.70	14.50
18	739.00	4400.00	.72	.00	57.00	350.00	2.40	4.00
19	741.00	4411.00	.72	.00	57.00	350.00	2.40	4.00
20	740.20	4403.90	.72	.00	48.80	505.00	2.40	11.10
21	740.20	4403.90	.72	.00	48.80	505.00	2.40	11.10
22	740.20	4403.90	.72	.00	48.80	464.00	3.10	14.70
23	741.40	4404.80	.72	.00	31.70	505.00	2.40	11.10
24	741.40	4404.80	.72	.00	31.70	505.00	2.40	11.10
25	732.50	4387.80	.72	.00	76.20	426.00	4.20	16.00
26	732.50	4387.70	.72	.00	76.20	425.00	4.20	15.50
27	732.50	4387.70	.72	.00	76.20	425.00	4.20	15.50
28	732.50	4387.70	.72	.00	12.20	718.00	4.30	26.60
29	739.00	4401.10	.72	.00	93.60	483.00	4.90	12.60
30	739.10	4401.10	.72	.00	93.60	483.00	4.90	12.60
31	739.10	4401.10	.72	.00	93.60	405.00	4.90	12.60
32	739.10	4401.10	.72	.00	93.60	405.00	4.90	12.60
33	739.10	4401.50	.72	.00	6.10	654.00	.80	24.90
34	740.00	4387.00	.72	.00	7.60	720.00	3.60	22.40
35	740.00	4387.00	.72	.00	10.10	816.00	3.30	30.20
36	742.40	4405.50	.72	.00	6.10	654.00	.80	25.20
37	746.00	4399.00	.72	.00	45.70	444.00	1.40	12.80

study was conducted to determine if the de minimis levels would adversely impact a Class I area.

The EPA PTDIS program was run in relatively flat terrain for varying stability-windspeed combinations to determine the expected allowable incremental changes in air quality at varying emission rates and to estimate concentrations associated with these emission rates at various distances from the source (Section 3.7). Table 12 lists the distance from the source at which a 1 $\mu g/m^3$ maximum 24-h air quality impact would occur for varying emission rates with a 30-m effective stack height. Table 13 lists the distance from the source at which a 1-$\mu g/m^3$ maximum 24-h air quality impact is estimated to occur for a 40-ton/yr change in emissions with effective stack heights of 13, 30, and 122 m. This assessment was performed with meteorological conditions that provided the highest estimated concentration for each of the above effective stack heights (i.e., worst case). In addition to the use of the worst case stability and windspeed, the estimated concentrations and associated downwind distances were reviewed for all the stability-windspeed combinations and the maximum distance where a 1 $\mu g/m^3$ maximum 24-h concentration is expected to occur was selected. The results are presented in Table 14.

TABLE 12. ESTIMATED AIR QUALITY IMPACTS[a]

Mass emission rate, tons/yr	Distance at which 1 $\mu g/m^3$ impact occurs	Concentration, $\mu g/m^3$			
		At 3 km[b]	At 5 km[b]	At 10 km[b]	At 30 km[b]
250	≅30	10	4	2.5	1
100	≅10	4	2	1	0.4
50	≅ 5	2	1	0.5	0.2
25	≅ 3	1	0.5	0.3	0.1

[a]"Worst case" meteorological conditions--B stability class (unstable), windspeed 0.5 m/s (light winds).

[b]Model results transformed to 24-h averaging time by Volume 10 techniques; distance and concentrations valid for any inert nonreactive pollutant for a 24-h averaging time.

TABLE 13. ESTIMATED DISTANCE AT WHICH 1 μg/m³ MAXIMUM 24-h CONCENTRATION IS PREDICTED TO OCCUR FOR A 40-ton/yr CHANGE WITH WORST CASE METEOROLOGY

H′	Stability	Windspeed, m/s	Distance, km
13	D	1	20
30	B	0.5	5
122	A	0.5	3

TABLE 14. ESTIMATED DISTANCE AT WHICH 1 μg/m³ MAXIMUM 24-h CONCENTRATION IS PREDICTED TO OCCUR UNDER ANY METEOROLOGICAL CONDITION

H′	Stability	Windspeed, m/s	Distance, km
13	D	1	20
30	D	1	20
122	B	0.5	5

On the basis of these results, a Class I area in level terrain should not be impacted adversely by a de minimis change of 40 tons/yr unless the proposed modification would be within 20 km of a Class I area. It should be noted that the meteorological condition (D stability and windspeed of 1 m/s) associated with a 40-ton/yr emission change (from an effective stack height of 13 m) that is estimated to have a 1 μg/m³ maximum 24-hour impact 20 km away may have a relatively low frequency of occurrence on an annual basis nationwide. A limited analysis of nine locations geographically spread across the county was undertaken to determine the frequency of occurrence for D stability and a windspeed of 1 m/s. The results of this analysis indicated that the average frequency of occurrence for D stability and a windspeed for 1 m/s was approximately 2 percent. Although the frequency of occurrence will vary from area to area (1 to 3 percent for the areas analyzed), there is a indication that the frequency of occurrence for D stability with a windspeed of 1 m/s will generally be quite low. Therefore, a review of some of the other more typical or representative meteorological conditions was undertaken. This review indicated that the distances where a 1 μg/m³ maximum 24-h concentration could be expected to occur ranged from 2 to 8 km. Therefore, in many cases, sources making a 40 ton/yr change and locating more than 10 km from a Class I area would not have an impact of greater than 1 μg/m³ maximum 24-h concentration.

Since many Class I areas will be located in areas with elevated terrain, the Valley model[7] was used to determine the effect that elevated terrain might have on the maximum distance where a 1-μg/m³ maximum 24-h concentration is predicted to occur

as a result of a source making a 40-ton/yr change. The Valley model was run for effective stack heights of 13, 30, and 122 m and three stability and windspeed combinations (B, 0.5 m/s; D, 1 m/s; and F, 2.5 m/s). The stability classes and windspeeds were selected to be consistent with the conditions used in the PTDIS modeling, which provided the maximum concentration and downwind distance, and the procedures set forth in Volume 10.[1] Volume 10 indicates that F stability and a windspeed of 2.5 m/s should be used to estimate the impact at receptors in elevated terrain to determine if terrain is likely to be intercepted. The basic approach was to situate a receptor grid at various distances on elevated terrain downwind from the source. Terrain heights were chosen to coincide with expected maximum impact locations and expected 1-$\mu g/m^3$ maximum 24-h concentration locations. The results from the Valley model are presented in Table 15. Two items should be noted regarding these results. The first is that for unstable/neutral atmospheric stability conditions (B and D stability), the plume in the Valley model is assumed to maintain a constant height above the terrain. "The plume parallels the terrain feature by increasing and decreasing its effective height relative to the stack base; this is, in effect, a flat-plane situation [as shown in the upper sketch of Figure 26]. These conditions may therefore lead to an underestimation of concentration in complex terrain"[7] and therefore more stable conditions should be used (i.e., F stability) as indicated in lower sketch in Figure 26. Since B and D stability conditions in the Valley model are more representative of flat terrain situations, it would seem that the results should be directly comparable to those from the PTDIS model, which indicated that these conditions would provide a maximum distance of 20 km. However, the results from the Valley model indicate that the maximum distance would be from 5 to 10 km. The major reason for this apparent discrepancy is that the Valley model uses a sector averaging approach to estimate concentration. "The bivariate Gaussian formulation is converted to the cross-section averaging form for a 22.5° sector. Such a conversion results in a uniform concentration across the wind sector at a given distance and height."[7] In some cases the averaging over the sector will produce results that are slightly less than those obtained for a given distance when PTDIS is used.

Therefore, based on the results obtained from PTDIS and Valley, 10 km represents a realistic approximation of the distance beyond which a 40-ton/yr emission change would not significantly impact a Class I area.

4.8 NUMBER OF SOURCES AFFECTED BY THE PROPOSED DE MINIMIS EMISSION LEVELS

Changing the current definition of modification to the proposed definition would have far-reaching effects on the applicability of the PSD regulations, as shown in Table 16. There are 151 modifications for which PSD permits have been issued and for which data were gathered as part of a survey of the PSD permits

TABLE 15. ESTIMATED DISTANCE AT WHICH 1 μg/m³ MAXIMUM 24-h CONCENTRATION IS PREDICTED TO OCCUR FOR A 40-ton/yr CHANGE IN ELEVATED TERRAIN USING THE VALLEY MODEL

H′	Stability	Windspeed, m/s	Distance, km
30	F	2.5	10
	B	.5	5[a]
13	F	2.5	10
	D	1	10[a]
122	F	2.5	10

[a]For those conditions in the Valley model, the plume is assumed to maintain a constant height above terrain, which in effect is a flat-plane situation.

issued from April 1, 1978, to November 1, 1979. These modifications were obviously subject to current regulations. Of the 151, 79 had controlled emissions above the cutoff of 100 or 250 tons/yr without any emission reductions elsewhere within the source, so these 79 would also be subject to the proposed regulations; 52 had controlled emissions below the cutoff of 100 or 250 tons/yr, and had one or more pollutants for which controlled emissions exceeded the de minimis levels without any offsets indicated; the other 20 had no pollutant for which controlled emissions exceeded the de minimis levels. If all 52 were major for the pollutant exceeding the "de minimis" levels, these modifications would be subject to the proposed regulations, but if some of the 52 sources were not major, then some would not be subject. Therefore, 52 is the outside estimate of the number of modifications below 100 or 250 tons/yr that would be subject to review. The actual number may be somewhat less, depending on the major source status of the existing source. The proposal, however, would clearly exclude the modifications (20) that resulted in emissions less than the de minimis levels, regardless of whether or not the sources were major.

The following conclusions were drawn from the analysis of the proposed and current definitions of modification.

1. Of the modifications subject to the current regulations, 14 percent would not be subject under the proposed regulations.

2. Of the modifications subject to current regulations, 52 percent would be subject under the proposed regulations.

3. Of the modifications subject to the proposed regulations, 34 percent may or may not continue to be subject, depending on whether or not the sources were major before the modification and whether the sources could offset the increases by using the netting provision.

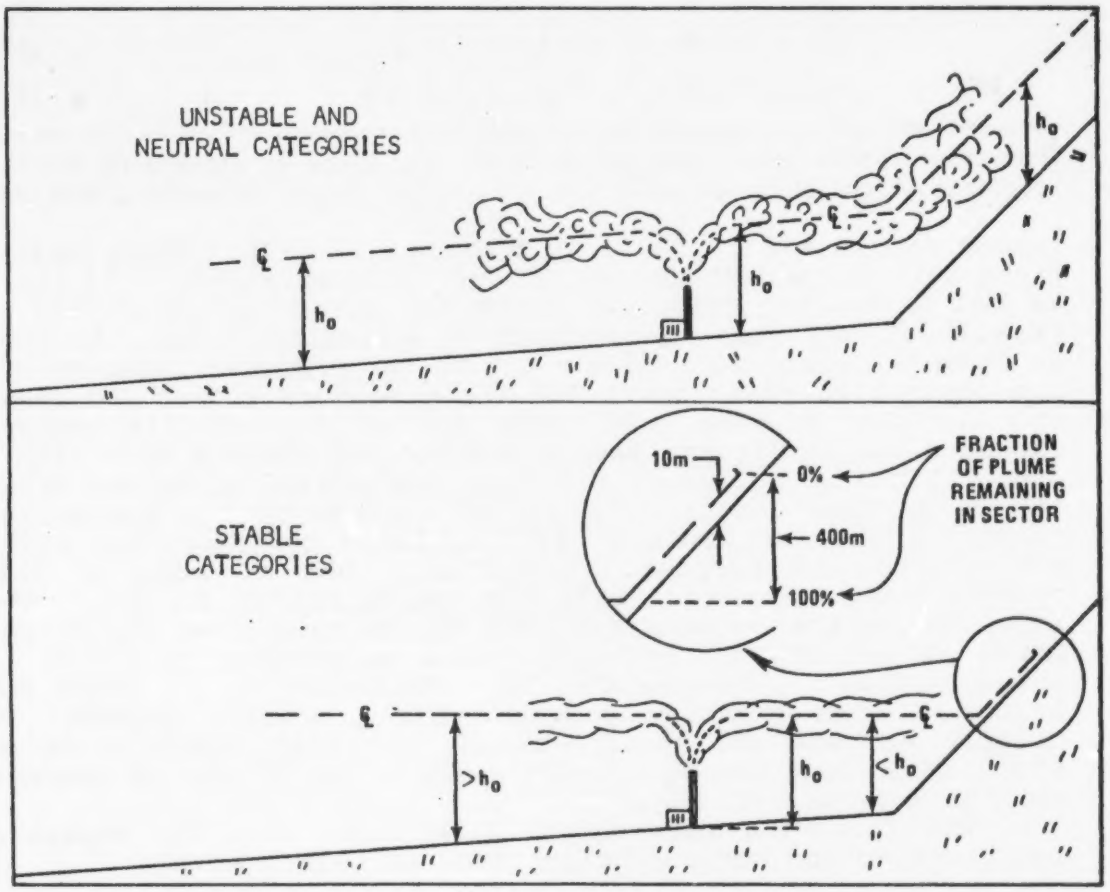

Figure 26. Depiction of plume height in complex terrain, as in the Valley Model; h_o is the height of the plume at final rise above ground for the unstable and neutral cases and above stack base for the stable cases.[7]

TABLE 16. EFFECTS OF PROPOSED REGULATIONS ON MODIFICATIONS REVIEWED UNDER CURRENT REGULATIONS

U.S. EPA region	Number of modifications	Number with >100 or 250 tons/yr controlled	Number with <100 or 250 tons/yr	
			Above de minimis levels	Below de minimis levels
III	13	5	6	2
IV	38	15	17	6
V	10	6	3	2
VI	49	32	14	3
VII	9	4	4	1
VIII	12	4	4	4
IX	18	11	5	2
X	2	2	0	0
Total	151	79	52	20

Based on the data, a higher percentage of modified than new sources would be subject under the proposed regulations, but the actual numbers of modified and new sources appear to be less than under the current regulations. This conclusion could be erroneous, however, especially for modified sources, since only modifications with more than 100 or 250 tons/yr were subject to PSD review and the number of modifications subject to the proposed regulations but not to the current regulations could not be obtained from the permits. Major modified sources that would increase emissions above the de minimis limits, but that would have increases of less than 100 or 250 tons/yr were not subject to the current regulations, but they would be subject to the proposed regulations; currently these are only subject to the State's new source review procedures. In fact, many States do not consider modified sources of 10 to 20 tons/yr a major source of emissions, so these sources are reviewed only to ensure that they meet the State's emission limits unless there is evidence that air quality problems may exist as a result of the modification.

States do not summarize and thus do not routinely report to EPA the amount of emissions from minor sources, but these data would be in the State permit file. Determination of how many sources a year would have emissions more than de minimis but less

than 100 or 250 tons/yr would require a review of all of the States' permit files. Since a detailed review of all State permit files could obviously not be undertaken, selected States were contacted to obtain a representative sample of the number of modifications that could be subject to PSD review under the proposed regulations. Data from Connecticut, Vermont, New York, Massachusetts,[8] Ohio,[9] North Carolina,[10] and Florida[11] on the estimated number of modifications above the de minimis levels and below the cutoff of 100 to 250 tons/yr were put into four categories based on the population of the states surveyed: greater than 15 million, 5 to 15 million, 1 to 5 million, and less than 1 million people. These data, which represented the modifications that would receive permits in any 1 year, were used for a rough estimate of the number of modifications that might fall into this category for the entire United States.

The estimate of the total number of modifications that are not subject to the current regulations but that would be subject to the proposed regulations was obtained by multiplying the estimated number of permits to be issued for a given population range by the number of States having a population in that range. This amounted to approximately 5000 modifications per year (values obtained ranged from 3400 to 6600). No estimate was made, however, of how many of these modifications would occur at existing major sources. In order to obtain some estimate of how many of these modifications may occur at major existing sources, a review of the NEDS file was undertaken. According to the information in NEDS, there were approximately 56,000 point sources in the NEDS system as of January 1979. Of these, approximately 12,000 were major sources (i.e., with emissions of any criteria pollutant greater than 100 tons/yr). Based on an estimate that there will be 5000 modifications per year, this would mean that approximately 10 percent of the existing 56,000 stationary sources would be modified in any given year. This estimate seems realistic, based on some limited data from the State of Louisana that indicated that approximately 100 TSP or SO_2 sources received State new source review permits during 1978. If the same percentage of modifications per year for all sources in NEDS holds true for those emitting greater than 100 tons/yr, then approximately 1200 of the 12,000 sources with emissions greater than 100 tons/yr would be expected to modify their source every year. Therefore, the estimates obtained from the state agencies would seem to represent the total modifications that would be expected per year. Thus, the number expected only from those with existing emissions greater than 100 tons/yr would be approximately 1200. Based on the proposed definition, it is estimated that approximately 1200 additional modifications per year would be subject to PSD over and above those that are now currently subject to review and would continue to be subject to review based on the proposed de minimis levels.

Because the above estimate was developed as a result of communication with state agency personnel rather than a direct

review of the files, no estimate was obtained on the distribution of these modifications based on their total emissions. Therefore, it is difficult to obtain an estimate of the number of additional modifications that would be affected under alternative de minimis levels.

Although the de minimis levels are pollutant-specific, very few sources emit just one pollutant. Therefore, a pollutant-specific analysis does not necessarily provide an indication of the absolute number of sources that would be subject to review given certain de minimis levels. In other words, even though a source would no longer be subject to review for TSP because it had emission changes of less than 10 tons/yr, it would still be subject to review if it had SO_2 emission changes of 20 tons/yr. To obtain some estimate of the total number of currently permitted modifications that would be subject given specific revised de minimis emission levels, all 151 modifications included in the survey of PSD permits were evaluated and categorized according to the greatest amount of emission changes from any of the criteria pollutants that would be emitted from the source. For example, if a source had emission changes of 10 tons/yr of PM, 25 tons/yr of SO_2, 30 tons/yr of NO_x and 110 tons/yr of VOC, it was categorized as having emission changes of greater than 100 tons/yr. Therefore, unless the de minimis levels were raised to above 100 tons/yr for VOC, it would still be subject to PSD even if the de minimis levels for all other pollutants it emitted as a result of the change were raised to 35 tons/yr. The results of this analysis are shown in Figure 27. Only five criteria pollutants were considered in this analysis since none of the modifications reported emission estimates for lead and very few provided estimates for noncriteria pollutants.

If the same general emissions distribution of modifications for which PSD permits have been issued to date holds true for those modifications that were not previously subject to review, then one can obtain some estimate of the impact of selected de minimis levels for all modifications (those currently subject plus those not currently subject to PSD) that would be subject to PSD review as a result of the proposed regulations. Figure 28 combines both these data sets on modifications by using the distribution for the ones that have received permits to date.

The estimate of the total modifications that could be subject based on various de minimis levels as shown in Figure 28 assumes that all proposed de minimis levels would be the same for all pollutants. If different de minimis levels are suggested for each pollutant, a specific analysis of the 151 modifications that received permits would be needed for each combination of de minimis levels considered. To determine the difference in selecting various de minimis levels by pollutant versus selecting one common level, the following de minimis level combination was evaluated: TSP at 25 tons/yr, SO_2, NO_x, and HC at 40 tons/yr, and CO at 100 tons/yr. As a result, approximately 74 percent of the modifications would be subject, compared with 68 percent if

40 tons/yr were used for all pollutants, as indicated in Figure 27. Given that the modifications that are currently not subject to PSD have the same general distribution of sources and emissions as the modifications that are currently subject to review, approximately 890 of the 1200 additional modifications would be subject to the proposed regulations given the above de minimis levels of TSP, SO_2, NO_x, and CO of 25, 40, 40, 40, and 100 tons/yr, respectively. (If 40 tons/yr for all pollutants were considered de minimis this would be 816 of the 1200.)

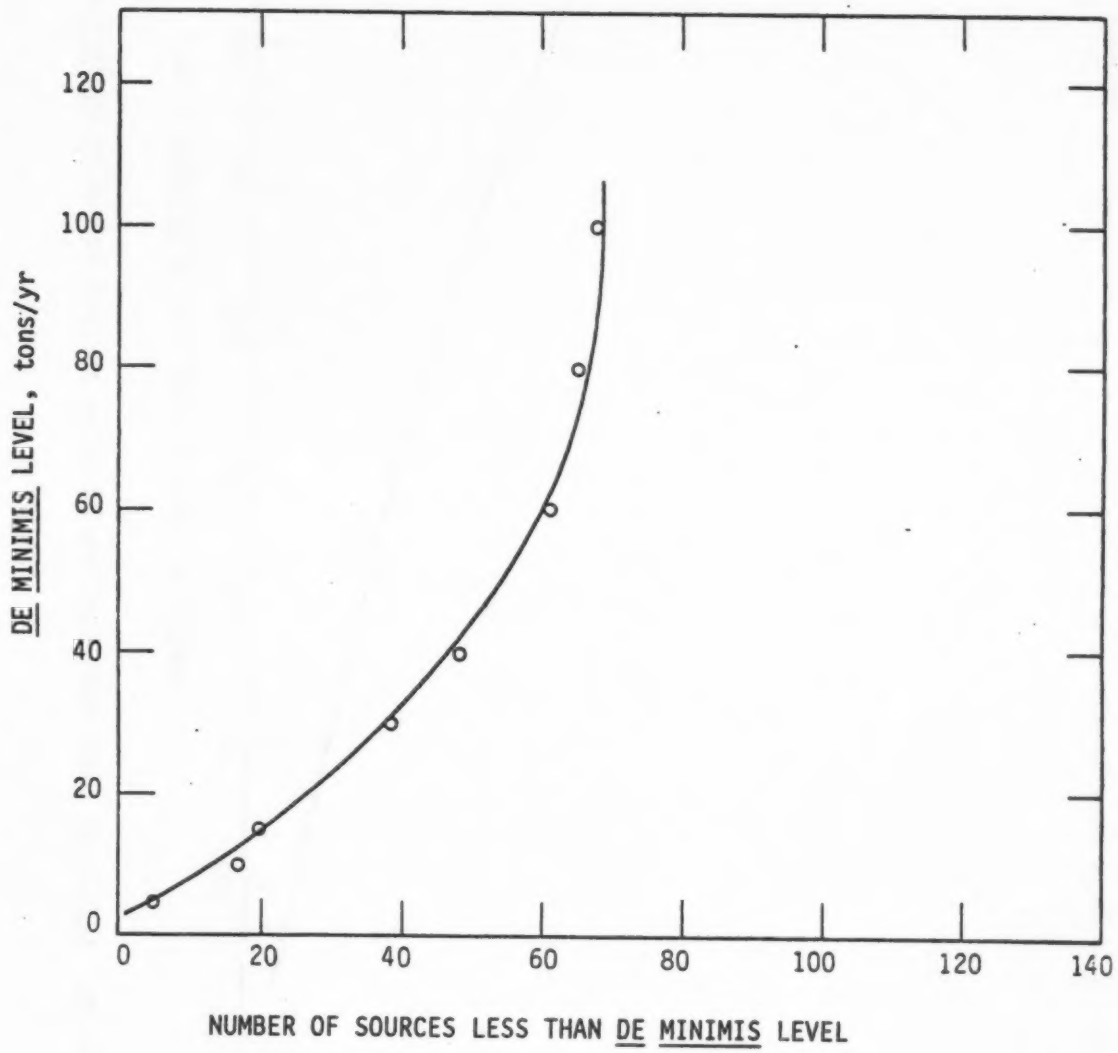

Figure 27. Number of current modifications subject to PSD versus de minimis emission rates.

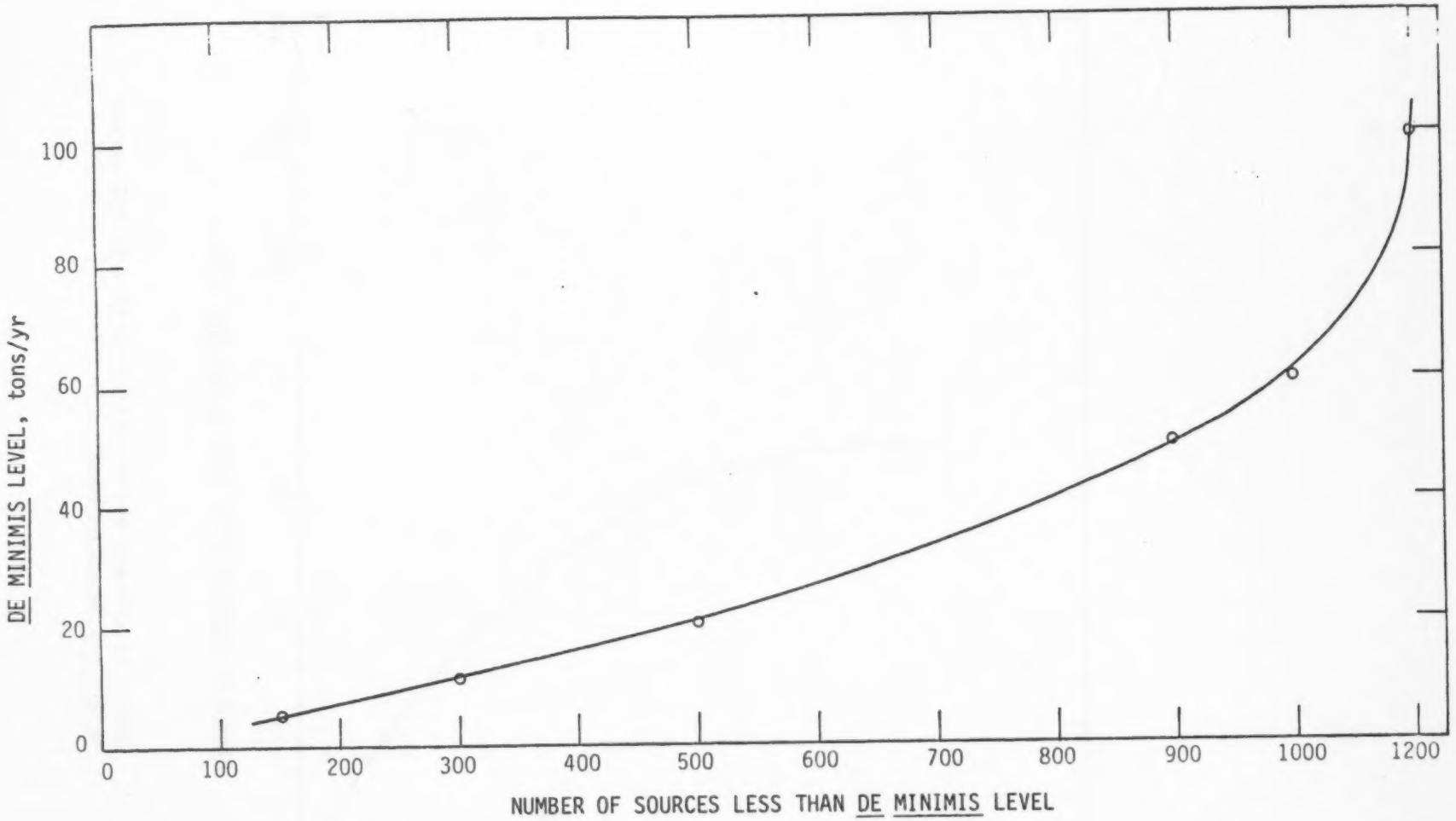

Figure 28. Number of total modifications at major sources versus de minimis emission rates.

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